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## CIVIL ENGINEERING.

*Extracts from the Report of* Prof. Alex. D. Bache, *Superintendent of the Coast Survey, showing the Progress of that Work for the year ending November*, 1849.

Continued from page 90.

Section I.—*From Passamaquoddy Bay to Point Judith, including the coast of Maine, New Hampshire, Massachusetts, and Rhode Island.*—(Sketch A.)

3. *Astronomical and Magnetic Observations, &c.*—Mount Independence, near Portland, was occupied as an astronomical station by my party. It is nearly two degrees and a half north of Nantucket, and but thirteen minutes west of it: the arc of the meridian passing through Nantucket, will, however, be prolonged nearly a degree further north by the occupation of a station in direct connexion with this, increasing considerably the value of the measurement of the arc.

The observations for latitude were made with a new zenith telescope by Simms, of London, (C. S. No. 3,) and the zenith sector, by Simms, described in my report of 1846. The plan of observation was to determine the latitude with the zenith sector, by observations of certain standard stars, and the declinations of the smaller stars used in the zenith telescope with the same instrument, employing these in the computation of observations for latitude with the zenith telescope instead of the catalogue places. The results, stated in my report of last year, of the performances of the zenith sector, pointed out this course, and the trials now made will show conclusively its value. So far, the field computations confirm the advantages assumed for the method. I shall, at another time, present the numerical data for comparison. It may turn out that the errors of the catalogue are sufficiently corrected by multiplying the number of pairs of stars. The

observations with the zenith sector were chiefly made by Sub-Assistant George Davidson and myself; those with the zenith telescope and with the transit instrument (C. S. No. 1) for time, in connexion with the other observations, by George W. Dean, Esq., under my immediate direction; those for azimuth with the 30-inch theodolite, by me personally, assisted by Mr. Davidson and Mr. Dean. In connexion with the determination of latitude, 323 observations were made with the zenith sector on 11 standard and 73 other stars, 174 observations with the zenith telescope by Talcott's method on 35 pairs of stars. For azimuth 52 observations were made on Polaris and delta Ursæ Minoris, near the eastern and western elongations, and 58 on the elongation mark. The same mark by day, and lamp by night, were used for the meridian mark for the transit, and for the elongation mark in observing azimuth. For time, in connexion with the foregoing, 101 transits were observed on 16 stars.

A meteorological register was kept at both stations by Mr. J. R. Smead, in which 249 observations of the Hassler standard barometer, and 226 of the aneroid barometer, were recorded, and 249 observations of the temperature and wet bulb hygrometer, besides miscellaneous observations of force and direction of wind, &c.

Vidi's aneroid barometer is so promising as a marine barometer, that I have taken some pains to keep up the comparison with the standard of one made in London. The results will be stated hereafter.

Observations for magnetic declination, dip, and intensity, were made at both stations—at the first by Mr. Dean, and the last by Mr. Davidson—the declination (variation) and intensity with declinometer No. 22, by Jones, of London, (C. S. No. 1.) The observations at Mount Independence were interrupted by frequent magnetic disturbances attending auroras. Sixty-nine sets of observations for declination on four days, three for intensity on two days, and three for dip on three days, were made at Pattuccawa, and eighty-six sets for declination on three days, three for intensity on three days, and three for dip on three days, at Mount Independence.

The work was closed, to proceed to section V for the measurement of a base line on Edisto island, near Charleston, on the 27th of October.

Magnetic observations were made at or near five secondary stations in this section by Professor George W. Keely, of Waterville College, Maine, for the charts of Lynnhaven bay, Marblehead, Salem, Gloucester, and Annisquam harbors. The instruments used were, for declination a unifilar magnetometer, by Jones, of London, in the possession of Professor Keely, and at the latter stations declinometer No. 22, by Jones, (C. S. No. 1.) The observations for horizontal intensity were made with the first named instrument, and for the relative total intensity with two Lloyd needles, with weights. For magnetic dip, a circle by Barrow, with compound microscopes, was used. The dip circle and the Lloyd needles, as well as the unifilar magnetometer, are those heretofore employed in his observations by Professor Keely. At Little Nahant station, 951 observations were made on four different days, including three sets for declination, (variation,) three for horizontal force, two for relative total force, and three for magnetic dip. At Fort Lee, Salem, the local attraction was found so considerable that, after observing in different positions near each other, the station was abandoned. Codden's hill (see sketch A, secondary triangulation near Salem)

was examined for the same purpose, and the local attraction found also to be great there; and Baker's island was finally fixed upon for the full set of observations. Eight hundred and forty-one observations were made on four different days at this station, comprising three sets for declination, with declinometer No. 22, three for horizontal force, and two for dip. At Codden's hill, 217 observations were made on five different days for declination, with declinometer No. 22. At Beacon hill, near Gloucester, 1100 observations were made on six different days—namely, five sets for declination, with the unifilar, three for horizontal intensity, two for relative total intensity, and two for dip. The declination was also observed at Annisquam, on the north side of Cape Ann, and comparative dip observations to detect the local disturbance; which, however, was not found to exist.

The observations for difference of longitude between Cambridge and Liverpool, by the transportation of the chronometers of the British mail steam vessels of the Cunard line, have been continued by Professor W. Cranch Bond, who has furnished eighty-seven additional observations during the year. The difficulties attending the procuring, in an authentic scientific form, of the observations for time at Liverpool, and the consequent uncertainty introduced into the determinations, induced Professor Bond to propose to me, in the spring of last year, to undertake a special expedition, in which chronometers belonging to the survey, or hired expressly for the purpose, and arranged for the expedition, should be transported with special reference to it, between the observatories of Cambridge, Massachusetts, and Liverpool, England.

The general plan was matured in consultation with Mr. Bond and Assistant S. C. Walker, and the execution was confided to Mr. Bond. Mr. Hartnup, director of the observatory at Liverpool, entered with great zeal and assiduity into the plan, and has contributed most essentially to its success. All the arrangement for procuring and transporting the chronometers, and for their speedy and safe delivery on their arrival at Boston and Liverpool, have been made by Mr. Bond, with the kind assistance of Mr. Hartnup. The observers on the two sides have adopted, for the most part, the same Nautical Almanac stars in obtaining their local time; and the same forms of reduction and the personal equations have been obtained through Mr. Richard Bond, who made comparisons with the observers at Cambridge and Liverpool, and took charge of the chronometers in the first trip from England. The number of chronometers compared is forty-four, of which fifteen are by Fletcher, twelve by Dent, and the rest by other makers. These have been transported in the Cunard steam vessels under charge of their officers, being separated into sets for the purpose of varying the circumstances of the voyages, and of increasing the opportunities of observation soon after their arrival at each observatory within the limited season during which it was judged expedient to prosecute the expedition. It is proposed to resume operations as soon as the season again becomes favorable. The results already obtained are of decided interest, indicating a change in the longitude, as given by astronomical observations, of nearly two seconds of time.

Professor Bond has furnished observations of 18 occultations (12 immersions and 6 emersions) between the 1st of January and 27th of Sep-

tember, 1849. Several of these occultations were observed by more than one observer, the number of results communicated being 26.

Mr. Bond and his assistant, George P. Bond, Esq., also took part in the telegraphic observations for differences of longitude in January, July, and August last, when the records were made by the methods devised by J. J. Speed, Esq., and Dr. John Locke.

The astronomical observations at Nantucket for the use of the survey have been continued during the past year by William Mitchell, Esq., who reports 94 observations of transits of the moon, and of moon culminating stars; 8 occultations; 116 observations for latitude, with the prime vertical transit; and 120 meridian passages for time, with the West Point repeating circle.

A very interesting report of Professor O. M. Mitchell, of Cincinnati, on the mechanical record of astronomical observations, will be found in the appendix No. 5. Professor Mitchell gives a brief account of his first experiment on the 26th of October, in recording the successive seconds indicated by the pendulum of a clock upon a Morse telegraphic register, and of the experiments immediately following this; a more extended notice of his disk for recording right ascensions, one of the most perfect of the methods of registering now in use, and which was communicated to me in February, 1849, and indicates the degree of accuracy attained already by this method, and the saving of time which it effects in observations of right ascensions. The report then goes on to describe a mechanical method for registering differences of declination, which is in the highest degree ingenious, and the results of which are so directly applicable to our work, that I have induced Professor Mitchell to undertake by it the measures of the declinations of the small stars used in our zenith telescope observations.

SECTION II.—*From Point Judith to Cape Henlopen, including the coast of Connecticut, New York, New Jersey, Pennsylvania, and part of Delaware.*—(Sketch B.)

12. A thorough comparative examination of the specimens of the bottom, obtained in this section, has been in progress by F. Pourtales, Esq., under suggestions from Professor Baily and Professor Agassiz. At the date of Mr. Pourtales's report (September 29) more than seven hundred and fifty specimens had been examined, and the classified results of the physical characters and microscopic examinations entered in tables. A comparison has also proceeded, in connexion with this, of the descriptions affixed to the specimens when brought up, and they have been examined both wet and dry. In his report Mr. Pourtales remarks: "All the sand covering the bottom of the sea off Long Island and New Jersey appears to be composed of the constituent parts of granite or sienite, viz., quartz, feldspar, hornblende, and mica, quartz being always preponderant. The proportion of the other materials makes the difference of color. This difference in the proportion, together with the degree of fineness, varying from pebbles to mud, must be the result of a kind of winnowing process produced by the combined action of tides, waves, and currents."

The study of the distribution of the organic remains according to depth, which is the prevailing circumstance, is of great interest to the naturalist, and is readily deducible from that in progress by Mr. Pourtales for our

special purposes. That this subject admits of a real application in the hands of navigators, will not be doubted by anybody who will take the trouble to look at the specimens of bottom containing these animal remains with a common pocket lens, or even a reading glass. Mr. Pourtales remarks: "The difficulty of using a compound microscope at sea had made me at first diffident of the practical utility of this study, but I find now that for all purposes, except those of the zoologist desirous of distinguishing sub-genera and species, a lens of small power, or even the naked eye, is amply sufficient."

After a few minutes bestowed on such an examination, by a person undertaking it for the first time, it is curious to see the interest which it excites, and the facility with which some of these specimens are recognized by the naked eye. Many of the species are so large that they can readily be picked out from among the sand with the point of a penknife. This thorough examination by one person will secure uniformity in our off-shore chart, and has already suggested more than one "remark;" and, in regard to the examination of the minute animal remains, "should there be any well characterized species circumscribed in a well determined space, and abundant in individuals, so as to give a good clue to navigators in regard to their position, the fact cannot escape being brought to light by the present mode of working."

SECTION III.—*From Cape Henlopen to Cape Henry, including the coast of Delaware, Maryland, and part of Virginia.*—(Sketch C.)

3. *Differences of Longitude by Telegraph.*—During the summer, observations were made for connecting the "Seaton Station" with Western Reserve College, so as to bring into use, for the longitude of our stations from Europe, the observations of moon culminations and occultations made by Professor Loomis at the Hudson observatory, and since reduced both by Professor Loomis and Lieutenant Gilliss. The instruments at the stations are automatic, on the plan of Joseph Saxton, Esq., registering on a metallic cylinder, or cylinder covered with paper, the circuit being made and broken by the pendulum of the clock.

Every facility was furnished by the Hon. B. B. French for using the telegraph line between Washington and Philadelphia, and by J. D. Reid, Esq., for the western telegraph lines—the local superintendents making great efforts to prevent interruption to our work from the consequences of the prevalence of epidemic cholera. The thanks of the survey are also due to the Hon. Elam Alexander, for his liberal offers in regard to the use of the southern line of telegraph, and to Henry O'Reilly, Esq., for the facilities which he has rendered to us on his lines. It will be a matter of great interest to reach New Orleans both by the western and southern routes, for which Cincinnati offers on the one side an intermediate station through the arrangements with Professor O. M. Mitchell, and Charleston on the south through those of Professor Lewis R. Gibbes.

The correspondence with Elam Alexander, Esq., President of the Washington and New Orleans telegraph line, is given in appendix No. 9. The same liberal spirit has been shown towards the coast survey by the directors of the western Morse lines, constructed by Henry O'Reilly, Esq. The thorough and cardinal co-operation on the part of the presidents, superin-

tendents, and operators of the telegraph lines, greatly facilitates the connexion of the stations in longitude, and bids fair to furnish, in the end, a new and important element for the reduction of the work. It is not only the mark of a liberal but of a patriotic spirit pervading those who have connexion with these important agents of modern civilization.

The telegraph operations of the coast survey have furnished four independent series of observations for difference of longitude between the stations of Washington and Philadelphia, the latter and New York, and between New York and Cambridge. The facility of obtaining results by the automatic printing methods, and their superior accuracy, will enable us to add still further to the value of our determinations. The progress of the art has been so rapid, that it seems now almost perfect; and yet no doubt the appliances will be much improved as experience develops the minor defects, and ingenuity suggests the remedies. The present condition of the telegraphic lines themselves is such, that the difficulties increase very much with the length of the wire, from the differences of meteorological circumstances, some part of it being exposed to storms of rain or showers which break the connexion of the whole. Intermediate stations are thus of advantage, not only in consequence of the information in regard to the longitude of the places themselves, but as increasing the opportunities for telegraphic communication within a given period of time.

The art of telegraphic operations has now reached a point at which it becomes necessary to inquire whether the velocity of the galvanic current is susceptible of measurement. An attempt to determine this was made by Assistant S. C. Walker, in January last, the results of which were deemed of sufficient interest to be communicated (under approval of the Treasury Department) to the American Philosophical Society, and were printed in their proceedings. Previous to the introduction of the automatic printing method for the registering of the transits of stars, this element was insensible.

SECTION IV.—*From Cape Henry to Cape Fear, including part of the coast of Virginia and the coast of North Carolina.*—(Sketch D.)

1. *Measurement of Base.*—As stated in my last report, the measurement of the base, six and three-quarter miles in length, was commenced in November.

The base was alligned and approximately measured by Assistant C. O. Boutelle. The allignment was made by a Gambey theodolite, or by sectors made by Temple, pegs being driven and copper nails placed in them to mark the line. At every 400 metres a large peg was driven, and alligned with much care, so as to be used in determining the line in measuring, a tripod, with a heavy iron plumb-bob suspended by a cord, being placed over these marks.

The base was measured by the compensating apparatus planned by me, and executed in the office of the survey by Mr. Würdeman. Its peculiarities have been described in a former report. Its length was invariable at different temperatures, and through changes of temperature. The apparatus was compared in length with the standard iron bar before the measurement was commenced, when near the middle of the base, and after closing the measurement. Two hundred and sixty-one observations were

made on six different days for this purpose, at temperatures varying from 67°·2 to 33°·9, a portion of them being as near 32° as could be obtained. The measures were very accordant in their results. In making these observations, the apparatus was placed between two stone posts, plumbed in wooden boxes without top or bottom, which were sunk in the sand to the depth of nearly three feet; the knife edge at one end pressing against the plane end of a short cylinder, and the agate plane at the other against a point turning a mirror, as in Mr. Saxton's pyrometer. The reading telescope and scale were attached to a post opposite to that last referred to. The steadiness of the posts was quite unexpected, the results being superior to those obtained previously in the office.

The measurement was commenced on the 4th and completed on the 23d November, the weather having been moderately favorable in the interval. Ten days were employed in the actual measurement.

At the end of each day's work, three heavy pieces of timber or blocks of stone were placed under the ends of the tubes, and marks made on them corresponding to as many measures, the marks being made by the assistance of the sectors, or of a 6-inch Gambey theodolite. At the ends of the tubes nearest to the several miles, stone posts were sunk, with copper bolts inserted and duly marked. The measurement was begun at the north end of the base, and both extremities were secured by granite posts resting upon a stone foundation, and this upon a platform of timber below the surface of the water, which is generally found here at less than three feet distance below the ground. The actual extremity is marked by a copper nail in a cedar stake driven in the axis of an earthenware frustrum of a cone, and corresponding to which is a hole in the platform. In the heavy stones forming the foundation a copper bolt marks the same point. The prolongations of the base, and a perpendicular to the ends, have been marked by posts with copper bolts, and pains have been taken to secure the monuments at the terminations.

The facility of measurement on this site, from its level character, was very great, and if it is not secure from the invasions of the ocean or sound, it is at least as secure as any level part of this coast. A few parts of the line where grading was required through low sand hills or in hollows, had been prepared previous to commencing the measurement, or were graded at intervals during its progress.

The trestles supporting the tubes of the base apparatus were placed upon iron plates resting upon the surface of the sand.

The least distance measured in any one day was 528 metres in $5\frac{1}{4}$ hours, and the greatest was 1692 metres (1·06 miles) in $8\frac{1}{2}$ hours. In the work generally I was assisted by Assistant C. O. Boutelle, who directed the forward tube; in making the contacts in measuring, by Sub-Assistant J. Hewston, Jr. The allignment was preserved by Sub-Assistant Joseph Ruth. The trestles were set by T. McDonnell, Esq. The records were made by Mr. B. H. Duncan. In preparing the apparatus for comparison of lengths with the standard bar, and in making such incidental repairs as were required, Mr. J. Clark, of the office of weights and measures, rendered valuable service.

After the measurement was made we repeated part of it on a portion of the line, which admitted of stakes being permanently placed below the ex-

tremity of each second tube, for comparison. The length of twenty-two tubes was then remeasured four times, making in all about one-third of a mile. The probable error thus found for the whole length of the base, (1807 tubes,) or nearly $6\frac{3}{4}$ miles, was less than one-tenth of an inch. On the hypothesis in regard to these repetitions most unfavorable to the accuracy of the measurement, the error for the whole length was less than three-tenths of an inch. The circumstances being somewhat unfavorable to the first day's measurement, it was repeated, and the second measurement of 88 tubes (about one-third of a mile) differed less than $\frac{1}{200}$th part of an inch from the first.

To be Continued.

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*On the Construction of Arches with Hollow Cast Iron Voussoirs.**

In the construction of cast iron bridges, it has generally been the practice to form a framework by means of ribs stretching across the full span in one or more pieces, in the form of an arch or otherwise, which ribs are stiffened or kept steady by transverse beams, diagonal struts, and ties; thus adopting, to a certain extent, the system followed in the construction of many of the wooden framed bridges, previous to the introduction of iron in being wholly used for such works. This, no doubt, is a very excellent mode of construction; but it is considered that, by adopting the system of stone bridges, and having the voussoirs formed of cast iron and hollow, a cheaper and easier constructed bridge could be erected, while the principle is one which possesses many peculiar advantages, and admits of being applied not only to arches of small, but also to those of very large spans.

In the framed system, the ribs, beams, &c., are generally very heavy, require much workmanship in their construction, are difficult to cast, and after good castings have been obtained are very liable to be damaged before being put in their places; thus causing the reconstruction of other castings, and consequently adding much to the expense, on account of the risk and delay. By the proposed system the castings become of an ordinary nature, require less workmanship, are easier constructed, very light and easily handled, and run less risk of being damaged; and even when a number of the voussoirs were damaged, the contingent expense would be very little compared to that arising from the loss caused by the damage of a large and massive beam. Such castings are consequently cheaper executed, the cost per ton for the same kind of castings being frequently not much more than one-half that of the other; besides, by a judicious arrangment and economy, no more, or at least very little additional, metal need be required by the proposed than by the framed system.

Both in ancient and modern times, hollow bricks have been used in the construction of arches, especially where lightness was required, and no great weight to be sustained, as these bricks were liable to be easily crushed. With cast iron this is, however, not the case, it being to a very great extent incompressible, the crushing weight for a square inch of cast iron being 140,000 lbs., while good stock bricks require only 12,000 lbs. to crush it, and in stone the crushing weight varies, according to the quality,

* From the London Civil Engineer and Architect's Journal, for June, 1850.

from 3166 lbs. to 6250 lbs. per square inch. Since hollow bricks have been successfully employed, it is easy to conceive that hollow voussoirs formed of such a hard and incompressible material as cast iron, may likewise successfully be employed, not only for arches of a small, but also for those of a very large span.

It is now an established principle, that when the materials of which an arch is composed are hard enough to resist compression, and the abutments sufficiently strong to resist being crushed or forced aside, there is no particular limit to the extent to which, if properly constructed, the span may not be carried. Of course, no substance being incompressible, it follows that there must be a limit beyond which the arch would destroy itself, but that limit will be greater or less according to the hardness of the material employed in the construction. An arch constructed of granite is capable of being carried to a greater span than one of good freestone, and still more so than one of freestone of an inferior quality, or of brick not sufficiently fired. And following out the same principle with hollow cast iron voussoirs, a still greater span could be accomplished than with any of these other materials.

Besides the advantage of cast iron voussoirs, on account of its extreme hardness, it possesses another advantage, that of lightness, these voussoirs being capable of being made sufficiently lighter than the same constructed of stone, and still retain sufficient strength to resist the required pressure. The weight of material in a cast iron arch would be from $\frac{1}{4}$th to $\frac{1}{5}$th that of a stone one, supposing the depth of the voussoirs was made the same in each, which however would not always be necessary, as when constructed of iron less depth would be sufficient, on account of its extreme hardness, the weight being so considerably diminished, and the pressure being more uniform over the entire surface of the joint: the surface of castings being much smoother and evener than that of an arch stone, which, except in very particular cases, is generally only neatly hammer dressed.

Again, in the framed system usually adopted, the pressure is thrown on a very small surface, which is not the case in the proposed system; likewise the use of malleable iron is entirely avoided, it being purely a cast iron arch, every part of which contributes its due proportion of resistance, forming a firm and compact mass, and possessing all the advantages of a stone arch.

Taking into consideration these many advantages—namely, the extreme hardness of the material employed, the decrease of weight and the superiority of the joint compared to stone arches, and the large extent of bearing surface compared to that of the framed system, it is surely not unreasonable to say that an arch on this principle may not only be carried to a greater extent than any hitherto constructed of stone, but equally as far, and perhaps further, than any that have yet been constructed of iron on the framed system. In the Grosvenor Bridge, across the River Dee at Chester, a stone arch has been successfully thrown over a span of 200 feet; and in the Southwark Bridge, across the Thames at London, which is formed of cast iron on the framed principle, the centre arch is carried to the extent of 240 feet; but with hollow cast iron voussoirs, an arch equal and even exceeding either of these spans may be executed with safety.

In the construction of an arch upon this principle, it is proposed to have

a raised piece cast on the side of each voussoir, fitting into a corresponding hollow on the one adjoining. By this means the whole becomes more firmly joined together, forming, as it were, a series of joggles throughout the whole structure, and entirely preventing any tendency of the arch to rise at the haunches, or of any of the voussoirs to slide. This is a very important advantage, and one which, in an iron arch, can be easily obtained with little or no additional expense.

Fig. 1.—Transverse Section of Voussoir.

Fig. 2.—Transverse Section of Arch.

The form of the voussoirs may either be made similar to those in stone bridges, with the addition of these projections and hollows, (see figs. 1 and 2,) or, where additional strength is required, they may be executed according to fig. 3.

Fig. 3.—Transverse Section of Arch.

On account of the voussoirs being all firmly fixed to each other by means of the joggles already mentioned, it would not, on all occasions, be necessary that they be placed close to each other at the ends, but kept a little separate, as shown in fig. 4. By this means, while the arch could still be made sufficiently strong, a considerable saving of material would be effected.

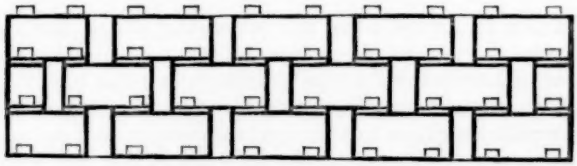

Fig. 4.—Plan of part of Arch.

As to the thickness of metal required for small and medium spans, the average may be from $\frac{1}{4}$ to $\frac{3}{4}$-inch, and for large spans one inch would be sufficient for the average, care being taken that the ends of the voussoirs be made thicker than the sides. In order still further to strengthen the ends without requiring additional metal, the sides may be made slightly open.

In places where stone cannot be easily obtained, bridges could be constructed on this principle at a very moderate cost, while they at the same

time would be both substantial and durable. The spandrils and abutments may be constructed of such materials as could be most readily obtained, and which was considered suitable, as such bridges admit of being finished similar to a stone one or otherwise, according to the taste of the projectors and resources of the locality.

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*On the Application of Water Pressure, as a Motive Power, for working Cranes and other kinds of Machinery.* *By* MR. W. G. ARMSTRONG, *F. R. S., Assoc. Inst. C. E.**

The object of the paper was to direct attention to the advantages of a more extended application of hydraulic pressure as a motive power, and to point out the means of attaining this desirable end; illustrating the arguments by descriptions and drawings of the engines on this principle already erected since the year 1845, when the author first designed a crane to be worked by the pressure of water from the street water pipes, at Newcastle-upon-Tyne.

The principle of these engines, as applied to cranes, was described to be very simple. In order to lift a weight, the water, under a pressure of about 100 feet head or more, being admitted through a slide valve into a cylinder, exerted a force on a piston, whose rod was connected with the hoisting chain, so arranged by passing over several pulleys, as to increase its length of travel to the requisite duty to be performed; the piston receding from the pressure therefore raised the weight to the height required. The lowering of the weight was accomplished by a reverse action, and the crane was turned in either direction by a similar action of a smaller cylinder, whose piston rod was connected with a rack, working into a circle of teeth, fixed to the base of the movable frame of the crane.

The action of these machines was described to be very smooth and steady, ingenious appliances being adopted for obviating the shock that would otherwise be caused by the sudden closing of the slide valves, and all the different operations being under the perfect control of a few regulating handles. In cases of a great diversity of power being required separate cylinders were used, so arranged as that their action could be combined according to the force required. The speed of working had no other limit than the size of the supply pipe.

Allusion was made to the advantage of employing hydraulic pressure in mercantile docks, for hoisting heavy weights, for whipping light goods out of ships, and for opening and shutting dock gates, swing bridges, and sluices. Its facility of transmission, its safety, and constant readiness for use, rendered its peculiarly suitable for these purposes. It would generally be preferable in such cases to employ steam power to force the water, rather than to be dependent upon town water works; and a tank upon a tower, or upon an eminence, would form a convenient magazine of power, enabling the engine to act continuously with an uniform load. Large air vessels had also been successfully employed instead of an elevated tank.

Hydraulic pressure might also, in many cases, be advantageously employed for purposes requiring continuous rotation. There were many

* From the London Civil Engineer and Architect's Journal, for June, 1850.

natural situations where mountain streams might be arrested, or surface water be impounded on elevated ground, and be conveyed by a pipe into a neighboring valley, where great mechanical efficiency might be derived from a small supply of water by the use of water pressure engines. In mining operations, also, the danger and inconvenience of underground steam engines might be obviated by substituting water pressure engines, conveying the water down the shaft in pipes, and returning it to the surface, by the action of the pumping engine above ground. In such cases the water was merely the vehicle for transmitting power into the mine.

A water pressure engine had been lately very successfully applied by the author in South Hetton Colliery, for the traction of wagons upon an underground railway. Similar engines had also been erected in the lead mines at Allenheads, for lifting ore and other purposes. Reservoirs were there formed upon the neighboring hills, and pipes were carried into the mines to supply the engines, the expended water flowing out by a level. Other engines of the same description were also in course of erection, for surface operations, at the same place, such as crushing ore and raising minerals from the shafts.

In their general character, these engines were similar to reciprocating steam engines. The slide valves were balanced by equal pressures in opposite directions, and were constructed to open very spacious water passages. The liability to concussion, on the closing of the eduction port, was obviated by the application of relief valves, which were lifted by the compressive action of the piston, causing it to act for an instant as a pump, in forcing back the opposing water into the supply pipe. In cases where the engines had been applied to hauling or winding, four cylinders placed diagonally in pairs had been used. In other cases two cylinders had been applied, the uniformity in the motion of the column being maintained by a loaded plunger. The winding engines were reversed by a slot link apparatus, similar to that of a locomotive engine, and which was worked by the pressure of the water, acting under the control of a valve. The regulating and reversing valves were each placed at the mouth of the shaft, at a distance from the engine, the operation of which could thus be directed with great accuracy and safety.

The drawings which accompanied the paper gave representations of an hydraulic crane, for shipping coals at Glasgow; hydraulic platform cranes, at the railway station, Newcastle-upon-Tyne; hydraulic hoisting machines, at the warehouses of the Albert Docks, Liverpool; a water pressure engine for a crushing mill at Allenheads; a similar engine used at the same place for winding, and numerous details of all these machines.—*Proc. Inst. Civ. Eng.*, *May* 7, 1850.

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### *Steam Haulage on Rivers and Canals.**

An experiment has lately been tried, with complete success, on the Gloucester and Berkely Canal, of a somewhat novel steam tug for hauling vessels instead of horse power. It consists of a continuous flexible rail or bar of iron running the whole length of the canal, and made fast at each

* From the London Civil Engineer and Architect's Journal, for June, 1850.

terminus. Above the deck of the tug are fixed a pair of rollers, between which this flexible iron band is placed, and as they are made to revolve by the steam engine on board, the grip which they take propels the boat. On the trial in question, after hauling various small craft of from 70 to 80 tons burden, she took in tow a Greek brig, laden with corn to the amount of 350 tons, which she towed against a head wind to the dock entrance, at a good walking pace. She hauled the common canal boats at a rate of 6 miles an hour, the speed being but little affected when going against tide. The cost of hauling in the Severn is a heavy item in the transit of goods, and this invention is calculated to diminish the expense 50 per cent., the consumption of coal being only 25 lbs. per hour.

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## *Steam Engine Economy. By* Robert Dempster.*

As one great object of the *Practical Mechanic's Journal* is the recording of facts in science and art, may I solicit for myself a corner in its pages, for the purpose of making known some economical arrangements which I made upon a steam engine in the fall of 1847? The engine in question is a low pressure condensing beam, with slide valves of the ordinary D kind; diameter of cylinder, 26 inches; stroke, 5 feet. It has two steam chests—one at each end of the cylinder, connected by a pair of columns, one of which acts as the steam pipe, whilst the other contains the exhaust passage; the whole exterior having the appearance of a piece of architecture of the Tuscan order. The D valves are made and packed in the usual manner, and the state in which I found them was as under:—

| | |
|---|---|
| Width of ports, | 3½ inches. |
| Length of ports, | 11½ " |
| Breadth of valve faces, | 3¼ " |
| Cover on steam side, | ⅜ " |
| Exhaust being ⅛ inch uncovered. | |
| Stroke of valves, | 8¼ " |

The alteration upon them I effected by the addition of a piece of brass to the steam side of each valve, with a change in the length of their connecting rod, and they are now in the following condition:—

| | |
|---|---|
| Breadth of faces, | 7 inches. |
| Cover on steam side, | 2¾ " |
| Cover on exhaust, | ¾ " |
| Lead, | ⅛ " |

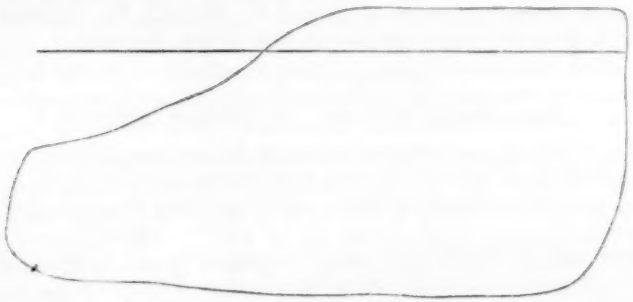
The state of the valves at the extremity of their stroke is—

| | |
|---|---|
| Bottom edge, opening on steam side, | 1 3-16 inches. |
| " " exhaust, | 3 3-16 " |
| Upper edge, opening on steam side, | 1 5-16 " |
| " " exhaust, | 3 5-16 " |

The difference of opening on the opposite sides arises from the angles formed by the connexions. With this arrangement, the valve cuts off the steam at three inches past the half stroke of the piston, and the expansion continues from this point up to four inches from the termination of the stroke; and at this time the exhaust port is two inches open.

* From the Glasgow Practical Mechanic's Journal, for June, 1850.

On the return stroke the valve closes the exhaust. When the piston is 11 inches from the end of the stroke, at the bottom of the cylinder, the piston has a clearance of $1\frac{1}{8}$ inches, and at the top $1\frac{1}{2}$ inches. Supposing the semi-revolution of the crank to be divided into 180°, steam enters the cylinder during the performance of 94°, expands during 56°, and throughout the remaining 30° the steam is open from the cylinder to the condenser, so that the steam has allotted to it about one-third the time to rush out that it has to rush into the cylinder.



The annexed diagram was taken from the cylinder after the alteration, when in the regular course of duty. It is clear evidence of the correct action of the valves, and must be considered in connexion with the fact, that the expansion is entirely accomplished by the ordinary slide valve, with a face on the steam chest rather bad than otherwise.

The boiler pressure was 3 lbs., the diagram showing $2\frac{1}{2}$ lbs. with a vacuum of 13 lbs., the speed of the piston being 290 feet per minute. In the *Practical Mechanic and Engineer's Magazine*, vol. iv. 1845, you will remember I advocated the adoption of increased speeds in conjunction with high expansion, and I think the case before us is a tolerable exposition of the truth of my views. When the engine was first set to work, it was calculated for the old rate of 220 feet, but it has been shown that it might even run much faster than its present rate of 290 feet. Previous to the alterations I have described, complaints were made of the occurrence of shocks on turning the centres. Now, nothing of this sort ever takes place, although the valve faces are perfectly parallel on the edges, and open the ports directly across at once.

Some engineers are in the habit of putting *curved* lap-pieces on the steam side of the valves, in order to wiredraw the steam on its first entering the cylinder, so as to avoid the shock, or soften the action, of the entering steam upon the piston. Now the best examples of modern stationary engines get their steam instantaneously by means of conical, equilibrium, and many other kinds of valves; and I am led to believe, from my own actual experience, that the slide valve, with the usual straight outline, is already sufficiently defective as a wiredrawing valve, without making it still more so by these shifts. It has been stated that the curve has been introduced to avoid *flushing*—that is, an unsteady foot-lathe-like motion, experienced when expansion is carried too far. This objectionable action, which is

most injurious in spinning establishments, is, I suspect, rather to be traced to the sluggish movement of the piston—an allegation which, until very lately, few engineers would admit.

The fact of the closing of the eduction port when the piston is 11 inches from the end of its stroke, in the engine to which reference has been made, may perhaps be termed an unavoidable evil. Unavoidable it is, but how far the evil goes remains to be seen. The diagram shows that the pent-up steam does not reach the atmospheric pressure, there being the clearance and ports to fill. On the other hand, whatever shutting-up action does occur, would appear only to affect the smoothing of the reverse motion of the engine. In starting the engine, much difficulty is experienced in getting over the first centre, owing to the lap on the steam side, and the two-inch lead on the exhaust; but once over, if the vacuum is tolerable, there is no more trouble.

*The Boiler.*—The boiler is of the common wagon shape, 21 feet long, with an internal flue. The heat, after traversing the bottom, returns along the internal flue, splits in front, and passes back again along both sides of the boiler, finally entering by the damper into the chimney. The heating surface is made up as follows:—Bottom of boiler directly exposed to the action of the fire, 27·5 square feet; bottom behind the bridge, acted on by carried heat, 88 feet; central flue, 149·1 feet; side flues, 168 feet; front end, exposed to carried heat, 13 feet; back ditto, 5 feet; total, 450·6 feet. The length of the heat's travel is 63 feet; originally the furnace bars were 18 inches below the highest part of the boiler bottom, and the furnace projected so far forward that the first three feet of the boiler appeared to get the greatest radiating heat from the incandescent fuel. Retaining the original area of furnace, it was led back 22 inches farther under the boiler, lowering also the furnace bars to the depth of 12 inches, so that their level was made 2 feet 6 inches below the boiler. In this re-arrangement every part of the furnace is covered by the boiler, the frame of the furnace door being built in below the angle iron of the boiler end, so that the door, when closed, stands in a line with the boiler end. The present dimensions of the furnace now are—Length of bar surface, 5 feet; breadth, 4·3 feet; making an area of 21·5 square feet. Its mean height being 2 feet, its capacity is equal to 43 feet.

The space under the boiler, from the furnace backwards, was made of considerable capacity, and the bridge was built up in every part to 4 inches from the boiler bottom. The area of the throttling-place is about one-fourth that of the internal flue, so that the current passes this part at its highest rate of velocity. The use of this throttling action I may here shortly discuss.

The fire is kept as thin as possible, and generally, notwithstanding the attention of the fireman, a quantity of air must always pass through the grate, without a chance of combination with the incandescent fuel; and in addition, the heat continually sets free the volatile gases of the fuel. Much of the carbon also passes away as carbonic oxide. This waste goes on to its fullest extent when there is a tolerably thick bed of half-burnt fuel on the bars. Without the application of some remedial agent, each product would get away in its independent state, but the throat answers the pur-

pose of forcing together and mingling the gases, turning the whole mass to account.

The bridge is always at a great heat, and at periods when there is little smoke distilling, the action of the fire upon it raises its temperature to the maximum, and when a fresh charge of fuel is applied this heat is to a considerable extent liberated, and taken up by the smoke and passing vapor. The heat thus partly acquired from the bridge renders the vapor fitter for combination, and the object of the large space behind the bridge is to allow room, so that the current may pass away at a slower rate.

As respects the quantity of air to be admitted to the furnace, if the fire is kept very thin, the necessary quantity will always find its way through; but if at any time too little should be thought to be passing through, a remedy is easily provided in leaving a portion of the bars uncovered. With such an arrangement, coupled with moderate attention on the part of the fireman, it is possible to prevent the escape of visible smoke; but the avoidance of all smoke does not, in this plan, act so economically as when a little smoke escapes at charging or stirring the fire.

I had no means of accurately measuring the quantity of water evaporated by a given quantity of fuel, so as to give the economical value of the boiler; and no one is justified in condemning any form or setting of the boiler before its evaporative powers are ascertained. I cannot help condemning the practice of estimating the qualities of engines by the pounds of coal consumed per horse-power per hour. The question should be—how many cubic feet of water, at a given temperature, does one ton of a certain fuel evaporate from the boiler, and in what time? And for the engine—how many pounds are raised one foot high by each cubic foot of water evaporated? at what initial pressure does the steam enter the cylinder? and at what point is it cut off?

Some method of this kind will keep separate the merits or demerits of the engine and boiler, and a fair estimate may be made of the qualities of each. In the example I have given, the modifications on each were effected at the same period; and the result is, that 26 cwt. of fuel now goes as far as 39 cwt. did before.

To effect the perfect combustion of the gases derived from coal, it appears to me that the following points should be attended to:—

1st, That abundance of air be admitted amongst the burning fuel.

2d, That the air be caused to enter the furnace to *some extent*, without passing through the incandescent fuel.

3d, That the air and gases be prevented from losing heat before the atoms of gas and oxygen from the air have had time to combine chemically.

4th, That, to obtain the last desideratum, the products of combustion should for some time be shielded from the cooling action of the boiler.

5th, That, to effect this, it appears to be necessary to form a large space behind the furnace bridge; in fact, a space of a sectional area equal to that of the boiler, the flame to enter this space near the bottom, and the said space to be enclosed with brickwork, to prevent radiation.

6th, That the boiler be made conical, like a sugar-loaf; the side next the ground to be set horizontally, or even to dip somewhat towards the small end; with such a contrivance the steam would not reach far back in

the boiler, and with the cold water introduced at its small end it would not instantaneously rob the warmer portion of the water of its heat.

The fire is supposed to be at the large end, as also the steam chamber. No return flue is required, as the boiler is presumed to be made long enough without it. This boiler would have the greatest heat of furnace where the hottest water is required, and as the products of combustion pass onwards to the small end of the boiler they diminish in heat, and in like manner the boiler will diminish in heat, until, at the small end of the boiler, the heat will be about the same as that of the injected water. Here, then, is a most simple arrangement for robbing the products of combustion of their last particle of heat. The taper of the boiler may run out as small as it is possible to make it, or keep it clean, and its length is indefinite.

*Blairgowrie, May*, 1850.

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## AMERICAN PATENTS.

*List of American Patents which issued in July*, 1850, *with Exemplifications by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improved Method of Fitting the Bows of Vessels;* Benjamin Barstow, City of New York, July 2.

The patentee says,—"The nature of my invention consists in making the cutwater of greater thickness or breadth than the forward part of the stem, to leave a space by each side for the receiving of sheathing timber, to cover and protect the forward part of the outer planking, and which also admits of giving better lines for the passage of the bow through the water."

*Claim.*—"What I claim as my invention, is making the rear edge of the cutwater to project on each side of the stem, to form a recess on each side, substantially as described, in combination with the sheathing pieces which fill up such recesses, and which cover and protect the ends of the plankings, and which also admit of giving better lines for the passage of the bow of the ship or other vessel through the water, substantially as described."

2. For an *Improved Method of Distributing the Air over the Heating and Cooling Surfaces of Air Engines;* Ernst Buckup, City of New York, July 2.

The patentee says,—"The nature of my invention consists in some improvements in hot air engines, whereby a greater economy of working is obtained, and also greater durability and efficiency are insured to the apparatus.

"My improvement consists in applying the inner plates to the hot air cylinders, to insure a more equal distribution of the heat, and also, by causing a current to pass over the heating and cooling surfaces, the liability to injury is greatly lessened."

*Claim.*—"What I claim as my invention, is causing the air, entering or leaving the cylinder, to pass over the heating and cooling surfaces in a thin stratum, by means of the plates or their equivalents, substantially in the manner and for the purpose set forth."

3. For an *Improved Sash Stopper;* Charles C. Cameron, Harper's Ferry, Jefferson county, Virginia, July 2.

*Claim.*—"What I claim as my invention, is the triangular-shaped double acting wedges or fasteners, placed within recesses of corresponding shape formed in the front or rear sides of the sash side bars, or in the side slats of a window frame, acted upon by any kind of handles or levers, in such a manner that they will press the sashes inwards or outwards, (in contradistinction to sideways,) and thus retain them in any desired position, and render them air-tight within the window frame."

4. For an *Improvement in Straw Cutters;* Reuben Daniels, Woodstock, Windsor county, Vermont, July 2.

*Claim.*—"What I claim as my invention, is the method of feeding straw, fodder, and

other substances to a series of rotating cutters, by means of a continuous motion by a roller armed with pointed teeth and hung in a swinging frame, substantially as described.

"I also claim the method of cutting straw, fodder, and other like substances by means of the cutting cylinder provided with cutters, the outer faces of which, from the cutting edge, are curved or inclined in towards the axis, so as to admit of continuous feed, the blades of the cutters acting as gauge plates for the length of the cut of the cutters, in combination with the feeding of the straw, fodder, or other substance to be cut, by a continuous motion, substantially as set forth."

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5. For an *Improvement in the Feeders of a Straw Cutter;* John E. Erb, Baltimore, Maryland, July 2.

The patentee says,—"My invention consists of a new combination and arrangement of devices, which, together, constitute a machine for cutting ears of corn, cork-stalk, straw, and other fodder, at once simple, efficient, and durable."

*Claim.*—"What I claim as my invention, is the guard-piece, in combination with the feed rollers, to carry the straw or other material to the cutters, as described."

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6. For an *Improvement in Setting the Teeth on the Concave of a Clover Thresher;* Jonathan Hibbs, Bristol, Bucks county, Pennsylvania, July 2.

The patentee says,—"The said improvement consists in so setting the teeth of the concave that there shall be a slight degree of elasticity given to them, so that they move out of the way of any stones, &c., which may accidentally get into the machine along with the clover, and after the obstruction shall have passed the tooth returns to its original position, without suffering injury by its passage."

*Claim.*—"What I claim, is the right to use and manufacture machines for the purpose of threshing and hulling clover and other seeds of a similar nature, having the teeth of the concave, or the stationary set of teeth, so inserted in leather on a bed of cork, as to give them an elasticity sufficient to cause them to resume their original position when misplaced by the passage of any foreign substances which may be introduced by accident or otherwise into the machine."

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7. For an *Improvement in the Cutters and Rakers of a Grain and Grass Harvester;* Hazard Knowles, Washington City, D. C., and Henry C. Bevington, Holmes county, Ohio, July 2.

*Claim.*—"What we claim as new, is, 1st, making the pointed cutters concave on the faces toward each other, in the manner and for the purpose set forth, by which the cutters are rendered self-sharpening and bending the upper plate over the back of the lower or sliding cutter plate, and bringing the notched or turned edge against the lower plate, in the manner and for the purpose described.

"2d, The arrangement of the stationary cyma-reversa fingers, in combination with the vibrating hook teeth or claws, bands, and the appendages for operating the same, by which the grain is collected into sheaves or gavels before being discharged upon the ground.

"3d, The combination of the hook teeth or claws, rock-shaft, bent arm, lever, spring, and revolving arm, for arresting the grain whilst removing the gavel or sheaf from the cyma-reversa fingers on to the ground; as described.

"We likewise claim the combination of the pinion, perch, and axle, the former working into the segment on the front axletree, for steering the forward part of the frame and cutters."

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8. For an *Improvement in Respiring Apparatus;* Benjamin J. Lane, Cambridge, Middlesex county, Massachusetts, July 2.

*Claim.*—"What I claim as my invention, is the valve made of any metallic substance, and the nose-piece having an air-tight tube surrounding that part which is designed to fit about the nose, to accommodate the features of any person; and the use of these, together with a cylinder, vessel, air chamber, or bag, for the purpose of enabling a person to breathe, with perfect ease, air which has been condensed more or less in any such cylinder, vessel, air chamber, or bag, which is to be confined to the person of the wearer while the surrounding air is impure from any cause."

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9. For an *Improvement in Collimating Levels;* John Locke, Cincinnati, Ohio, July 2.

*Claim.*—"What I claim is the mode substantially as described, of forming a levelling in-

strument by combining the spirit level with the collimator having a partial lens, viz., by means of a partial reflector, so placed as to reflect both the cross-wire and the spirit level bubble; in such manner that the image of the latter may be seen bisected by the image of the former when the instrument is horizontal, the image of the cross-wire being at the same time seen in optical contact with the distant point which marks the level with the observer's eye."

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10. For an *Improved Re-Immersing Amalgamator;* Joseph R. Miller, Fredericksburg, Spottsylvania county, Virginia, July 2.

*Claim.*—"What I claim as new, is the combination of the revolving basin, and its attached tubes or spouts, with the trough containing mercury, the tubes having sufficient length to force the issuing currents to the bottom of the mercury, or nearly so, and their discharging orifices being above the surface of the mercury, which latter peculiarity causes the streams, as they pass and enter in succession, to force below the surface any particles of metal which may not have been amalgamated by the first immersion."

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11. For an *Improvement in the Seeding Apparatus of Seed Planters;* Lewis Moore, Bart, Lancaster county, Pennsylvania, July 2.

The patentee says,—"One characteristic of my invention is the attainment of a uniform and steady distribution of the seed by means of oblique slots in the sliding gauge or feeding plate, in connexion with slots in the grate plates beneath the floor of the hopper, whose sides are either parallel with those of the hopper, or of different obliquity to those of the gauge apertures.

"Another common defect in seed planters exists in the absence of any ready control over the feed while the machine is in motion; and in order to get rid of this defect, I cause the motion of the gauge to be communicated by a rod terminating in a hook convenient to the hand of the operator, and which, by being inserted by him into any one of a set of holes at varying distances from the centre or fulcrum pin of a vibrating bar, any desired rate of feed can be attained, or, by abstracting the hook, can be temporarily suspended when the machine is passing over ground not intended to be sown, or in turning the machine at the end of the furrow; and all this can be done without arresting or altering the speed of the team."

*Claim.*—"What I claim as my invention, is, 1st, the employment of a reciprocating sliding guage plate, when said plate is provided with oblique feed openings, in combination with openings in the grating plates of different obliquity, and bottom of the hopper, for increasing or diminishing the quantity of seed to be sown while the machine is in motion, by adjusting the end of the connecting rod nearer to, or farther from, the fulcrum of the vibrating bar, and thus increasing or diminishing the traverse or sliding movement of the gauge plate.

"2d, I also claim the combination of the hooked connecting rod, arm, vibrating plate provided with a series of holes, (arranged in the arc of a circle scribed from the pivoted end of the rod,) and undulatory cam, with the reciprocating sliding gauge plate, by which the reciprocatory movement of the sliding gauge plate is regulated for the purpose of increasing or diminishing the feed or sowing of the seed."

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12. For an *Improved Lock Bolt for Shutters;* Joseph Nock, Philadelphia, Pennsylvania, July 2.

*Claim.*—"What I claim as new, is the bolt having a slot through which the key passes, which will admit the bolt to be moved back sufficiently far to prevent the spring catches from catching in the notches in the bolt, in combination with a key guard, which renders it necessary to remove the key before the shutters can be opened, substantially in the manner and for the purpose set forth."

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13. For an *Improved Arrangement of Cutters in a Grain and Grass Harvester;* Jacob Peirson, Wilmington, Delaware, July 2.

*Claim.*—"What I claim as new, is, 1st, the arrangement substantially as described, of cutters bolted to an endless belt, revolving in a vertical orbit, and moving on a rail guarded and disposed after the manner described."

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14. For an *Improvement in Machines for Cutting Lozenges;* John W. Pepper, Salem, Essex county, Massachusetts, July 2.

*Claim.*—"What I claim, is the adjustive spring fingers connected to the two wheeled car,

said car being appended to the axle of the revolving cutters; the wheels and the screws that fasten the finger plate to the transverse bar preventing the finger plate from touching the sheet of paste during the operation of cutting the lozenges, as fully set forth."

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15. For an *Improvement in the Construction of Cooking Stoves;* S. H. Ransom, Albany, New York, July 2.

The patentee says,—"My invention consists in casting the fire bottom and front hearth, or summer arrangement, in one piece, by making the connecting part inside of the front plate of the stove, that the lower edge of the said front plate may be fitted directly on to the hearth plate, the inclination given to the connecting part for the draft in moulding, being thereby carried inside of the front plate; and also in combining this with the fitting of the said hearth plate with the bottom plate of the stove, and with the front edge of the bottom oven plate, by rebates or their equivalents, the fire bottom being extended under the lower edge of the fire back, with which it makes a good joint, the greater weight of the part in front of the stove tending constantly to keep this joint tight. And also in combining the manner of forming the said hearth and fire bottom, in combination with projections on the inner surface of the front plate, which bear against the inclined surface of the front part of the connexion between the hearth and fire bottom."

*Claim.*—"What I claim as my invention, is making the fire bottom and front hearth, or summer arrangement of the class of stoves herein specified, in one piece, connecting the two with inclined plates placed within the front plate of the stove, substantially as described, whereby I am enabled to have the hearth below the level of the fire bottom, whilst the inclination given to the connecting parts is not visible, thereby effecting the purposes specified.

"I also claim the above method of making the hearth and fire bottom, in combination with the method of connecting them with the oven bottom and stove bottom by means of tongues and grooves, whilst the fire bottom extends under the fire back, substantially in the manner and for the purpose specified.

"And I also claim, in combination with the above described method of making the hearth and fire bottom, the extension of the front stove plate down in front of the parts which unite the hearth and fire bottom; the said front stove plate being provided with projecting pieces to rest against the inclined joints, to aid in securing in place the said united hearth and fire bottom, substantially as described."

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16. For an *Improvement in Safety Tubes for Lamps;* Franklin Stewart, Philadelphia, Pennsylvania, July 2.

The patentee says,—"The nature of my invention consists in providing an inner pipe, to be stationary, inserted into a piece of metal or other material in the lamp, in such a manner as to receive the wick and permit the top of the lamp to be screwed on and off at pleasure, but so arranged that if a person attempted to remove the top whilst the lamp is burning the light or flame would be instantly extinguished."

*Claim.*—"What I claim as my invention, is the application or addition of an inner pipe or pipes, (one or more as the case may be,) inserted into a piece of metal or other material, as before described, being either stationary or revolving, thereby preventing the top of the lamp from being removed without drawing it over the inner pipe or pipes, and thus extinguishing the flame."

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17. For an *Improvement in Machines for Cutting Felloes;* Joseph and Levi Adams, Hadley, Hampshire county, Massachusetts, July 9.

The patentees say,—"The nature of our invention consists in the combination of certain movements with the shaft of the cutter-head, so arranged that the forward motion of the shaft will cause it to descend while the felloe is being formed by the cutters in the cutter-head, and as soon as that has been accomplished, will automatically throw the shaft upwards into its starting position."

*Claim.*—"What we claim as our invention, is the causing the shaft E of the cutter-head to automatically descend during its forward motion until the felloe has been formed by the cutters in the cutter-head, and then be thrown upwards to its standing position, substantially in the manner herein set forth: to wit, by resting the said shaft E upon the movable bar, which bar is forced upwards by a spring or weight, and has a rack and a pin connected to its movable end, the said rack being connected with, and caused to descend by the forward movement of, the cutter-head shaft, through the medium of the band, the shaft *f*, and the pinions on the shaft *g*,—which movements are thrown out of gear with the rack at the pro-

per time by the pin and the spring, which act upon the levers and the shaft *g*, substantially as herein described."

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18. For *Improvements in Condensers of Steam Engines;* Ethan Baldwin, Philadelphia, Pennsylvania, July 9.

*Claim.*—"What I claim, is combining with a tubular condenser the receiving and heating reservoir, which is connected at or near its top with the exhaust passage, and with one end of the series of condensing tubes, and at or near its bottom with the other end of the series of tubes, and with the exhausting and feeding pump; the whole constructed substantially in the manner and serving the purposes specified."

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19. For an *Improvement in Lath-Cutting Machines;* Charles Graff, assignee of William Bullock, Philadelphia, Pennsylvania, July 9.

*Claim.*—"What I claim as new, is the arrangement of the lever in combination with the quadrant, rack, pinion, ratchet, screw, and wheel, thereby moving the periphery of the log being cut, an equal distance at each stroke of the knives, (the log being moved by the chuck, instead of applying the power to the periphery of the log,) by which arrangement I can cut laths from square logs, substantially in the manner and for the purposes set forth."

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20. For an *Improvement in Quilting Frames;* Charles H. Cook, Coeyman's Hollow, Albany county, New York, July 9.

*Claim.*—"What I claim as my invention, is the adjustable quilting frame constructed in the manner described, whereby the strained surface of the quilt can be placed in an inclined position, and at any convenient height, thus enabling the quilter to preserve an erect position of the head and chest while at work."

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21. For an *Improvement in Apparatus for Cutting Dried Beef;* Gilbert S. Ward and Geo. F. Musselman, assignees of Daniel W. Goble, Newark, New Jersey, July 9.

The patentee says,—"The nature of my invention consists in providing or so arranging a set or series of knives, properly proportioned in size and shape, so as to form any convenient angle for regulating the resistance of the object to be cut in the best manner, to prevent its shearing off to one side when in the act of cutting the same, by adopting such an angle as will produce this desired result; the resistance to the object to be cut is neutralized by the reaction of the compound edges of these sections of the whole knife edge, (they are said to be a series of knives because they are made in three pieces for convenience, while, in reality, they represent one continuous knife,) when the object to be cut is passing in line with the centre between the two side section knives, and so on over the end or middle section knife, placed in the apex of the angle formed by the edges of the two side knives;—while, in the machines with the one oblique blade, the object to be cut is compelled to be kept against said edge by the force of the operator, instead of being regulated by corresponding knives opposite each other, as in my improved mode, which requires only the force of the operator to be principally employed in one direction, which direction is in line with the centre between the edges of the two side knives, and so on over the middle section knife. I also construct the face or bed of the machine so as to allow it to be graduated, to vary the thickness of the shavings to be cut."

*Claim.*—"What I claim as my invention, is, 1st, the combination of the knives forming an angle to each other, as described.

"2d, I claim the combination of the bed with the other parts, to graduate the thickness of the shavings, as described."

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22. For an *Improvement in Spiral Churn Dashers;* Cornelius R. and John Hight, Geneva, Kane county, Illinois, July 9.

The patentees say,—"The nature of our invention consists in the application of a reacting spiral revolving dash, attached to a box churn in a horizontal position. Our dash consists of a shaft and four arms; also two wings made of wood or tin, or any other suitable material. The peculiar construction of the dash consists in setting arms to which the wings are attached at right angles, upon opposite sides of the shaft, so as to produce a quarter twist in the wings as they extend along the shaft from one arm to the other."

*Claim.*—"What we claim as our invention, is the application of a reacting spiral revolving dash, (the wings of which may be constructed of wood or tin, or any other suitable

material,) to a box churn, as described and set forth, or to any of the usual forms of churns to which it may be attached to good advantage."

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23. For an *Improvement in Carts for Spreading Manure;* Joel K. Holland, Beaufort county, North Carolina, July 9.

*Claim.*—"What I claim, is the combination of the box, bottom, rollers, cylinder, cog wheels, and lever, arranged and operated substantially in the manner described."

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24. For an *Improvement in Lamp Tubes;* Isaiah Jennings, City of New York, July 9.

The patentee says,—"The nature of my invention consists in certain improvements in lamps, said improvements having for their object the regulating of the length of the wick, and adjusting the same without moving it up or down in the tube."

*Claim.*—"What I claim as of my own invention, is the combination of the two conical tubes, as shown, for forming a regulator for the flame of a lamp, substantially as described."

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25. For *Improvements in Revolving Hammer Fire Arms;* George Leonard, Jr., Shrewsbury, Worcester county, Massachusetts, July 9.

*Claim.*—"What I claim as my invention, are, 1st, a central hammer to be shifted from some convenient position so as to bear on the central cone, and to be driven by the usual operations of the lock.

"2d, A revolving carriage to carry and turn the hammer.

"3d, A trigger turning on a pivot in the cocking lever, and which is thrown forward into a position convenient to be drawn by pulling said cocking lever. The whole to be substantially as herein described."

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26. For an *Improvement in Sounding Boards for Pianos;* Conrad Meyer, Philadelphia, Pennsylvania, July 9.

The patentee says,—"The nature of my invention consists in supporting the bridge (on which the strings rest) upon a thin auxiliary piece of board, secured over an opening formed in the ordinary sounding board, substantially as represented."

*Claim.*—"What I claim as my invention, is the supporting the bridge upon a thin base piece secured over an opening formed in the ordinary sounding board, substantially in the manner and for the purpose as herein set forth."

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27. For an *Improvement in Seeding Apparatus of Seed Planters;* Samuel and Morton Pennock, Kennet Square, Chester county, Pennsylvania, July 9.

The patentees say,—"The improvements which we now desire to have patented relate to a new construction and arrangement of curved arms, forming part of the tubular drill tooth, or depositing tube, embracing the drag-bar, for diminishing or increasing the angle of the same with the drag-bar, to cause it to open a deeper or a shallower furrow,—to break the wooden holding pin and turn on the joint bolt when the tooth strikes against a stone or a stump, or other impediment, and thus save the depositing tube;—and likewise to turn in an opposite direction, without breaking the wooden pin, whilst backing the machine when the depositing tube is in the ground; and also to hook upon the axletree for suspending the depositing tube from the ground, to prevent it from being injured whilst moving the machine from the farm yard to the place where it is to be used upon its own wheels. Said curved arms serving also the purpose of braces to stay the depositing tube from any lateral movement during its operation, or when the machine is run backwark or turned short or suddenly whilst the tube is in the ground.

"Likewise in the employment of spring bearing plates for the boxes of the gudgeons of the seed roller, to confine it in its proper place, and yet be allowed to yield when the surface of the roller is uneven or swollen from any cause, and for adjusting the roller to the grate."

*Claim.*—"What we claim as new, is constructing the tubular drill tooth with a hook-shaped arm, in the manner and for the purpose herein set forth, by which the drill tooth is braced laterally whilst in operation, and hooked to the axle when not in operation, and by which the angle of the drill tooth may be changed at pleasure, by changing the position of the wooden pin in said arms, and by which the drill tooth may be folded towards the drag-bar in backing the machine, or turning short round, whilst the drill tooth is in the ground,

without breaking the wooden pin, said wooden pin resting upon the top of the drag-bar instead of passing through it, as herein fully set forth.

"We also claim the spiral or any other form of spring, in such combination with the hopper, grate, and seeding cylinder, or the distributing apparatus, as will make the said cylinder, and grate, and hopper, self-adjustant, each to each and to the others, in case there should be a want of evenness or uniformity upon the surface of the seeding cylinder or distributing apparatus, for the purpose and in the manner above set forth."

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28. For *Improvements in Chargers Attached to Fire Arms;* Orville B. Percival, East Haddam, Middlesex county, Connecticut, and Asa Smith, City of New York, July 9.

The patentees say,—"The nature of our invention consists in the modes of constructing and using a magazine containing powder, balls, and percussion seed, and attached to the breech of the gun, and made to turn over chambers in the breech of the gun, and drop balls, powder, and percussion seed, through perforations in the barrel of the gun, near the breech, and to be turned back half-way round under the breech, to cut off all communication and prevent explosions in the magazine when the charge in the gun is fired."

*Claim.*—"What we claim is the revolving ball magazine, as above specified, in connexion with the revolving cylinder."

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29. For an *Improvement in Machinery for Measuring Pulp in the Manufacture of Paper;* Henry Pohl, Paterson, New Jersey, July 9.

The patentee says,—"The nature of my invention consists in providing a movable lid in the regulator cylinder, the said lid being operated by a screw, to set the lid in the cylinder at any point desired, to regulate the quantity of pulp to be admitted, to make sheets of paper of any thickness.

"The nature of my invention further consists in providing the movable lid with an orifice in it, communicating with the pulp chamber of the cylinder, and with the atmosphere by a tube, at the bottom of which tube there is a small cylindrical air chamber, with a ball fitting to move up and down to act as a valve, to allow the air to pass out by the tube when the pulp is forced into the cylinder, and to close the tube when the air is all forced out; then to allow the air to rush in when the discharge gate is open, to assist in forcing out the pulp, and to do this with the utmost regularity."

*Claim.*—"I claim, in combination with the measuring vessel herein described, the adjustable lid, constructed with an opening in it communicating with the pulp chamber in the cylinder, and with the atmosphere through the small cylindrical chamber and the pipe, the communication being closed and opened by the ball, in the manner substantially as described, for the purposes set forth."

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30. For an *Improvement in the Boilers and Gearing of Locomotive Engines for Working Heavy Grades;* George E. Sellers, Cincinnati, Ohio, July 9.

The patentee says,—"My improvements are especially applied to locomotives for running on heavy grades, but are also applicable to running on level roads. The first part of my invention relates to an improvement in locomotive steam engines, secured to me by letters patent bearing date the 13th day of November, 1847, in which horizontal auxiliary driving wheels are used to gripe the central rail for overcoming heavy grades, the gripe of the said auxiliary wheels being effected by the draught of the train, and, when desired, aided by what I term a steam spring.

"In my original invention the auxiliary driving wheels, which are necessarily horizontal, are, from the nature of the general arrangement, placed at the back of the locomotive, and receive their motion from auxiliary engines through the intervention of cranks and bevel gear wheels.

"My present invention consists in communicating motion from the auxiliary engines to to the crank on the shafts of the auxiliary driving wheels by direct connexions, such as connecting rods, when this is combined with a separate shaft on which are placed the eccentrics for operating the valve gear of the auxiliary engines, which shaft has cranks at right angles, each connected with one of the auxiliary engines by a connecting rod to a cross head, at another part of the piston rod from that at which the connecting rods of the auxiliary driving wheels are attached. By these means the alternate action of the two engines on the auxiliary drivers is insured, and I am enabled to place these drivers in the middle of the locomotive, and to increase the length of the boiler, on an engine in the same length in the frame, and also to place the auxiliary cylinders below the boiler.

"The second part of my invention relates to the boiler, mainly with the view to adapt it to the inclination of heavy grades; and also to the obtaining of a better circulation of the water, and a more perfect combustion, with a view to economize fuel."

*Claim.*—"What I claim as my invention, is the method substantially as herein described, of operating the two horizontal auxiliary driving wheels of locomotive steam engines by connexions with the auxiliary engines, when this is combined with the connexion of the piston rods of the two auxiliary engines with a crank shaft having the cranks thereon at right angles, substantially as described, whereby the engines are made to alternate in their action as specified.

"I also claim the method substantially as described, of establishing a connexion between the dome and the forward end of the boiler, when this is combined with the extending of the flue tubes to the top of the boiler, as described, whereby the boiler is adapted to heavy grades, as described.

"I also claim, in combination with the water-ways surrounding the fire chamber, the water channel at the bottom of the boiler, as described, whereby a circulation of the water is established between the two ends of the boiler."

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31. For an *Improvement in Machines for Cutting Screws;* Thomas J. Sloan, City of New York, July 9.

The patentee says,—"The principle or character which distinguishes my invention from all other things before known, consists in determining the pitch of the threads by means of a leader which turns in the arms of a rocking shaft, operated by a cam so formed as, at the end of each threading motion, to disengage the threads of the leader from the teeth of a comb on a bar which operates or carries the tool-holder, and to re-engage them at the end of each return motion, when this is combined with a relief cam, which, at the end of each threading motion, acts upon the comb bar and pushes it forwards with greater velocity, to relieve the leader preparatory to its being disengaged from the comb, and then to ease the said bar in its back or return motion."

*Claim.*—"What I claim, therefore, as my invention, is the method substantially as herein described, of determining the pitch of the threads of wood screws by means of a leader, the threads of which are alternately engaged and disengaged from the teeth of a comb on a sliding bar, when this is combined with a relief and return cam, which, at the end of each threading motion, pushes the comb forward to relieve the leader before it is disengaged from the teeth of the comb, and then eases off the return motion of the comb bar, substantially as described."

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32. For an *Improvement in Store Counters;* Evan O. Thomas, Philadelphia, Pennsylvania, July 9.

The patentee says,—"The nature of my invention consists in making counters in sections of suitable lengths for removing when filled with goods; each section to be provided with a loose top, ends, and side, so that it has the appearance of being double when the top is not elevated. Inside of the above top and case will be constructed a chest, fitted loose enough for the casing and top to be elevated with ease when forced by the action of the axle and crank; the chest to be placed on two axletrees and four wheels, of suitable dimensions for removing the counter with ease without occupying too much room. The chest will be constructed with a double bottom, in the centre of which will be placed an axle with a tooth wheel to fit between the bottoms, allowing room for a catch.

"The ends of four cords, straps of leather, gutta percha, or chains of metal, will be permanently fixed to the axle, and running under the upper bottom on friction rollers, and ascending near the top of the ends of the chest, where they pass over friction rollers and descend between the chest and casing, where it will be fastened to the casing near the bottom."

*Claim.*—"What I claim as my invention, is the construction of a store counter, made in two parts in the manner described, for the purpose of varying the capacity within, and at the same time to give better security in case of burglary, and aid transportation in case of fires, as herein set forth."

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33. For an *Improvement in Joints for Compasses for Measuring;* Theodore Alteneder, Philadelphia, Pennsylvania, July 16.

*Claim.*—"What I claim as new, is a compass joint formed of two surfaces held together by centre screws passing through a cap piece, substantially as described."

34. For *Improved Machinery for Double Folding Wide Cloth;* Zachariah Allen, Providence, Rhode Island, July 16.

*Claim.*—"What I claim as my invention, is the use and application of the rigid prong or extension piece, to act upon the middle of the piece of cloth in the process of folding it, in connexion with the winding rollers, to secure the exact double folding of the cloth, as above described."

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35. For an *Improvement in Self-Weighing Machines for Grain, &c.;* W. W. W. H. T. Bramble, Lafayette, Tippecanoe county, Indiana, July 16.

The patentee says,—"The object of my invention is to furnish an apparatus that may be set to weigh or measure any number of bushels of grain without further attention or care than to set the apparatus, and set the grain to running into it from the loft in which it is contained; the rest of the work is then done by the machine, and registered on an index plate attached thereto."

*Claim.*—"What I claim therein as new, is the combination of a steelyard with a weighing box having several compartments which receive the grain alternately, and when a certain quantity has been received, the full compartment is discharged, being disengaged by the depressed position of the steelyard, and at the same time another compartment is presented for filling; the apparatus being operated by the weight of the grain itself, so as to form an automatic weighing machine, by which, with the aid of a register or index, the amount weighed is ascertained, substantially as above set forth."

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36. For an *Improvement in Horse Powers;* James L. Cathcart, Washington City, D. C., July 16.

The patentee says,—"My invention consists in improvements in horse powers for general agricultural uses, which combine the qualities of strength, portability, lightness, and durability in an eminent degree, as well as great facility for setting up and taking to pieces for transportation from place to place; and also an arrangement by which the horses can be taken in and out, and the arms and rim, while at work, be at that height from the ground which is the best for the attachment of the traces in the proper line of draught."

*Claim.*—"What I claim is the eccentric pivot, which, by turning round, allows the entire wheel to be withdrawn from the pinion, and when raised by the lever, the wheel can be tilted up for the purpose of taking the horses in or out, substantially as set forth."

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37. For an *Improvement in Hill-Side Ploughs;* William L. Chase, Boston, Massachusetts, assignee of Mark L. Chase, Frankfort, Waldo county, Maine, July 16.

*Claim.*—"What I claim is the combination of the adjustment of the hooked bar with those of the main brace, whereby the pitch of the mould-board may not only be increased or diminished, but the proper support of the upper part of the plough-share be maintained under any angle of pitch, all as specified. The same also admits of a change of the mould-board, viz: the substitution of one larger or smaller.

"I also claim the above described peculiar construction of the sward cutter, with its groove to receive the sharp edge of the land-side, in combination with the notch in the land-side of the share for receiving its lower end, and the notch or shoulder in the upper part of the sheath for receiving its upper end, substantially as specified."

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38. For *Improvements in Steam Boilers;* F. P. Dimpfel, Philadelphia, Pennsylvania, July 16.

*Claim.*—"What I claim as my invention, is, 1st, arranging a series of bent water tubes within the flue space of a boiler, and connected at each end with the body of water in the boiler, substantially as described, by means of which the circulation of water is greatly increased, and the injurious effects due to expansion and contraction avoided, substantially as described.

"2d, I also claim surrounding the crown-sheet, to which the ends of circulating tubes or their equivalents are attached, with a rim, substantially as and for the purpose specified.

"3d, I also claim extending the ends of the tubes, or the equivalents thereof, above the crown-plate or roof of the fire-box, or any other plate or plates one side of which is fire surface, to which they are attached, when the other or lower end communicates with a water space or spaces below or beyond the plate to which the upper ends are attached, substantially as and for the purpose specified.

"4th and lastly, I claim giving a forced circulation to the water through the boiler or generator by mechanical means, substantially as and for the purpose specified."

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39. For an *Improvement in Spring Saddles;* George Fisher, Raleigh, Wake county, North Carolina, July 16.

The patentee says,—"The nature of my invention consists in making the seat part of the saddle movable, and applying springs beneath it for the purpose of affording ease in riding. These springs may be of any suitable strength to suit the weight of the rider, and each saddle may be provided with two or more sets of springs of various forms and strength."

*Claim.*—"I claim the springs represented, or springs of any other form producing the same effect, placed between the movable seat and the body of the saddle, in such a manner as to be easily taken out and changed as described."

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40. For an *Improvement in Spike Machines;* Moore Hardaway, Troy, New York, July 16.

The patentee says,—"The nature of my invention consists in a new and useful combination and arrangement of mechanical devices, and mode of operating the same, by which the spike is cut from the heated rod, griped and held firmly between horizontal dies, bent down at one end, and hook-headed and rolled out longitudinally at the other end, and pointed between an inclined stationary and a rolling die; the several operations being performed almost simultaneously and at every revolution of a cam shaft, operated by steam or other power, by which hook spikes of a superior character are produced."

*Claim.*—"What I claim as my invention, is the method of imparting to the header a compound motion for first bending the end of the spike downward, and then moving it forward against the die to form the hook end, simultaneously with the operation of rolling the opposite end to the form of a wedge, with a roller of the same width of periphery as the thickness of the spike; the said header being fixed to the end of a turning shaft, passed through the lever, and inserted into a segmental cogged or toothed plate, made to match into a fixed segment rack, by which the angle of the header is changed to correspond with the required form of the head of the spike, as the lever is vibrated by the motion of the cam shaft, and the roller being moved in the arc of a circle as it rotates on its own axis, by being attached to the short arm of the bent lever, whose long arm is attached to a wrist of the wheel or plate on the cam shaft, as herein fully set forth."

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41. For *Improvements in Knitting Machines;* Joseph Holden, White township, Cambria county, Pennsylvania, July 16.

*Claim.*—"What I claim as my invention, is, 1st, the projecting and withdrawing the needles separately and singly, with their arrangement as described, by which I am enabled to knit closer work with stouter needles, substantially as described.

"2d, In combination therewith, I claim the combination of the jack, the sinkers, and depressers, substantially as described.

"3d, I claim the thread bearer, having an extended sideway motion to and fro at each stitch, by which it lays the thread across the needle at each stitch, and returns with it to be ready for the next stitch.

"4th, I claim the spring vice for regulating the supply of thread to the needle opened by the rod, substantially as described.

"5th, I claim the particular arrangement and combination of the several parts of the machine, by which their various motions are derived from a single crank and screw thread, substantially as described."

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42. For an *Improvement in Surveyors' Compasses;* John Locke, Cincinnati, Ohio, July 16.

*Claim.*—"What I claim as my invention, is the application of the partial lens, or lens of reduced size, by means of which to view a cross-wire or a sight mark in optical contact with the object aimed at, either in the compass, in gunnery, or for any other purpose requiring and using a sight in the manner herein described, or any other substantially the same, and which will produce the intended effect; especially do I claim also the arrangement by which my compass sight is made susceptible of having either end used as the eye-piece, and by which back and forward sights can be taken without disturbing the instrument.

"I also claim the convenient model of the compass to be used with the sight here described, viz: with a super-imposed plate, and with the sight planted and supported upon it, and with the opposite readings at such places as are required in order to obtain indirectly the reading of the occasionally concealed end of the needle."

43. For an *Improvement in Sizing Compounds for Warps or Yarns;* William Mallerd, Providence, Rhode Island, July 16.

*Claim.*—"I lay no claim to a combination of starchy matters and resinated alkalies alone, but my invention and what I claim consists, 1st, in the combination of the same and the composition of animal tallow, oil, and caoutchouc, in, or about in, the proportions specified, and for the purpose described.

"I also claim the combination of alcohol with the composition of resinous, alkaline, and other matters, as specified and for the purpose as stated."

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44. For an *Improvement in Machines for Cutting Veneers, &c.;* Conrad Poppenhusen, City of New York, July 16.

The patentee says,—"The principle of my invention consists in the application of a sliding carriage with knife, the latter fastened in such manner as not to break the veneer or board, and to cut the exact thickness; and the application of a spring, so as to cut the wood clearly off and throw the veneer out."

*Claim.*—"What I claim as my invention, is the application to machines for cutting veneers and thin boards, of a sliding carriage (or gate) with knife and spring, substantially in manner and for the purpose herein described."

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45. For an *Improvement in the Seeding Apparatus of Seed Planters;* George Rohr, Charlestown, Jefferson county, Virginia, July 16.

*Claim.*—"What I claim as my invention, is, 1st, the combination and arrangement of the segmental plates or valves, secured together by circular rings or heads, and arranged over the circumference of the cylinder, adjacent to the openings therein, with the rotating cylinder constructed as described, for the purpose of partially or entirely closing the openings in the cylinder through which the seed passes to the depositing tubes, and thus regulate or check the discharge of the seed as described.

"2d, The arrangement and combination of the elliptical spring, rising and falling beam, pivoted beam, and hand lever, with the depositing tubes and drill teeth, by which all the depositing tubes and drill teeth may be raised and lowered simultaneously as described, without stopping the planting.

"3d, The arrangement of segmental shields or covers on either side of the upper portion of the rotating cylinder, in combination with the intermediate semi-circular spouts or gutters beneath the cylinder, by which any waste of seed is prevented during the rotation of the cylinder, or its discharge from the openings before passing the segmental shields or covers, as described."

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46. For an *Improvement in Feeding Apparatus of Straw Cutters;* David Stiles, Jr., Middleton, Essex county, Massachusetts, July 16.

*Claim.*—"What I claim as new, is attaching the feed hand to the reciprocating knife-gate *below* the bottom of the feed trough, when said bottom is made with an opening next the knife, in which the feed hand operates, and through which all extraneous and hard substances descend before reaching the knife, so that whilst the said feed hand acts on the hay or straw, or whatever is to be cut, at its most compact part, it at the same time offers no obstruction to the insertion of the straw, as it stands entirely out of the way and leaves the top open and free, the opening in the bottom of the trough serving to rid the hay or straw, or cornstalks, of sticks, stones, and other objectionable substances which would tend to injure the knives."

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47. For an *Improved Apparatus for Regulating the Contraction of Car Wheels;* Samuel Truscott, Columbia, Lancaster county, Pennsylvania, July 16.

The patentee says,—"The nature of my invention consists in the gradual cooling of the hub of cast iron, by directing centripetal streams of cold air or water against the surface of the hubs of wheels cast in a chill."

*Claim.*—"What I claim as my invention, is the combination of the apparatus for directing the cooling fluid centripetally against the outside surface of the hub, when constructed in the manner herein set forth, with the apparatus for letting the sand descend from around the hub, and retaining it over and about the arms and rim, as described.

"I likewise claim the combination of the bed-plate, made with the curved conductor and slide to confine and discharge the sand, with the circular iron ring which forms and chills the tread of the wheel."

48. For an *Improved Steering Apparatus;* Charles F. Brown, Warren, Bristol county, Rhode Island, July 22.

The patentee says,—"The nature of my invention consists in operating the rudder by means of a steering wheel placed in a horizontal position directly above it, the wheel being firmly secured on the head of a screwed shaft or spindle, which has a bearing in the crown of a hollow metal pillar encasing the head of the rudder post, and secured to the deck or stage on which the steersman stands, and is prevented from moving up or down; the head of the rudder post is of metal, and has a metal cap provided with any convenient number of helical grooves, and on this metal cap a hollow metal socket is placed, having helical feathers or threads fitting to the grooves on the cap of the rudder post; the socket has also straight feathers fitting in grooves inside the pillar, and in its crown or head is a female screw, in which the screwed spindle carrying the wheel fits; the wheel being turned in either direction will cause the screw to elevate or depress the socket, and the helical threads or feathers in the socket acting upon the grooves in the head of the rudder post, will cause the rudder to turn in the same direction as the wheel."

*Claim.*—"What I claim as new, is operating or turning the rudder by means of the socket, so guided that it can be moved only in the direction of its length, and having helical threads or grooves fitting to corresponding grooves or threads on the head of the rudder post, and being moved in either direction in the line of the axis of the rudder post by means of a screw, attached to, and operated by, the steering wheel, substantially in the manner herein described."

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49. For an *Improvement in Truss Pads;* Frederick M. Butler, City of New York, July 22.

The patentee says,—"My invention consists, 1st, in the exact shape in which the case should be formed to adapt itself to the boundaries of the thigh and pubis, that being generally a rounded obtuse angle.

"2d, The proper quilling or curling of the outer and under edge thereof, adapted to the rotundity of the abdomen.

"3d, The exact and proper method of padding the same so as to suit the configuration to which it is adapted, and thus avoid making too great pressure upon the fullness of the abdomen, by bearing firmly with the raised parts of the pad which pass outward of, and underneath, the muscles of the abdomen and form a plano-concave pad."

*Claim.*—"What I claim as my invention, is the formation of the pads for trusses, braces, supporters, &c., as above described, to wit: made of shape in the boundary seen in the figures, (a rounded obtuse angle,) and the padding made somewhat hollow and fullest on the sides A A A A, adapted to bear under and outwards of the fullness of the abdomen, making a plano-concave pad, whether single or double."

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50. For an *Improvement in Fastening the Shoes of Hill-Side Ploughs;* William L. Chase, Boston, Massachusetts, July 22.

The patentee says,—"My invention consists, 1st, of a shoe or runner, so fitted to the lower edge of the land-side that it can readily be removed therefrom to be replaced by another, when worn, broken, or for any other cause it is required to remove it, this removable shoe being fitted with either sockets or pivots at its ends, to which the mould-board is connected, and on which it turns.

"The second part of my invention consists in making the land-side with two faces, but otherwise shaped and proportioned like the land-side of the ordinary plough for working level land, that turns the furrow in one direction only."

*Claim.*—"What I claim as new, is the device for attaching and detaching the removable shoe, having the mould-board hinged to it, and being fastened to the land-side, substantially as herein set forth."

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51. For *Improvements in the Method of Making Wrought Iron directly from the Ore;* Alex. Dickerson, Newark, New Jersey, July 22.

The patentee says,—"1st, The distinguishing features of my improvements are in substance as follows: The construction and arrangement, substantially as herein described, of a deoxidizing furnace, consisting of a crucible formed by the union at bottom of two concentric, or nearly concentric, cylinders, or other shaped vessels, having free circulation of the hot gases within and around them, so as to appropriate the heat of the gases from the puddling furnace freely and equally to all parts, while at the same time no portion of the heating gases, or of the atmosphere, is permitted to mingle with the ore, except what little of the former

may enter during the deposition of a charge or batch; the above being so combined and disposed in connexion with a puddling furnace, as that the deoxidized ore may be deposited on the puddling floor, and be converted into balls without having been exposed to the neutralizing contact of the atmosphere at any period of the process, or of its reduction from the ore into balls.

"2d, Such a form and disposition of the crucible as to insure an even and thorough distribution of the heat, and thereby to avoid the extremes both of excessive and of insufficient heat."

*Claim.*—"What I claim as my own invention in the above process for making wrought iron direct from the ore, is deoxidizing the ore in a chamber which is so constructed and arranged as to be heated by the waste heat, and at the same time prevent the product of combustion coming directly in contact with the ore, except during the time of charging, and likewise permits the charge of deoxidized ore to descend upon the puddling floor or working bottom without exposure to the atmospheric air; the whole substantially in the manner, and by the use of apparatus, substantially such as herein described."

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52. For an *Improvement in Machines for Raking and Binding Grain;* John E. Heath, Warren, Trumbull county, Ohio, July 22.

*Claim.*—"What I claim as new is, 1st, gathering the grain and compressing it into a sheaf, substantially as herein set forth, by means of the rake and standards.

"2d, Carrying the cord round the sheaf and holding the latter until the band is tied by means of the curved lever and toothed arms, substantially as described.

"3d, The employment of the split thimble and sliding hook, to aid in tieing the band.

"4th, Alternating the rake to gather the grain and compress the sheaf, by means of the spring, strap, and drum, substantially as herein set forth.

"5th, Bridging the space through which the bound sheaf drops, to support the grain while it is being gathered, substantially as set forth."

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53. For an *Improvement in the Application of Electro-Chemical Printing in Colors for taking Ayes and Nays;* Albert N. Henderson, Buffalo, New York, July 22.

The patentee says,—"My invention consists of an apparatus by which words, signs, letters, &c., can be permanently printed on paper or other fibrous substance, by a person or persons situated at a distance, by means of the galvanic current."

*Claim.*—"What I claim as new, is, 1st, the mode substantially as described, of imprinting words, letters, figures, &c., upon paper or other fibrous substances, by placing the paper or other substance, either chemically prepared or not, as above set forth, between two surfaces of a metal which is not acted on by the substances employed, on one of which the letters or figures are raised, by passing a current of galvanic electricity through the prepared material, substantially as above described.

"2d, I claim passing the electric current between metallic surfaces, as above described, through damp paper otherwise unprepared, and afterwards applying a chemical solution by which the effect of the electricity becomes visible whenever it has passed through the paper, for the purpose above described, telegraphing, &c."

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54. For an *Improvement in Directing Water upon Water Wheels;* Marcius B. Ashley, Watertown, Jefferson county, New York, July 30.

The patentee says,—The nature of my invention consists of three parts: 1st, The providing of a tramming or plumbing collar or box in the interior of the bed or lower stone, whereby the shaft can be plumbed at any time by the miller far more conveniently than by any plan heretofore used.

"2d, The construction and mode of operating the water gates.

"3d, The collar or boot of the shaft, to make it run always on a centre, and to be easily repaired, &c."

*Claim.*—"I claim the adjustable vertical water mouths or openings, arranged in combination with the outer or longest edge of the buckets, as described, whereby the greatest effect is obtained."

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55. For an *Improvement in Machinery for Turning Out Wooden Bowls;* Addison Everett, Middlefield, Hampshire county, Massachusetts, July 30.

The patentee says,—"The nature of my invention consists in turning wooden bowls from

blocks of wood by means of gouges, cutters, and spurs, fixed in strong movable frames, which are adjusted in such a manner as to insure a rapid and economical manufacture of bowls of any thickness or shape required; and in the simplicity of the cutters and spurs, which are easily made and sharpened."

*Claim.*—"What I claim as my invention, is the combination of the movable frames with the reciprocating frame carrying the curved cutter arm, connected and operating as described. Also the combination of the curved cutter arms with the reciprocating frame for the purpose described. And also the cutters, the spurs, and the guards, constructed as described, and connected and fastened to the curved cutter arms, in the manner and for the purpose substantially as herein described."

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56. For an *Improvement in Stanchions for Cattle;* George W. Hatch, Parkman, Geauga county, Ohio, July 30.

*Claim.*—"What I claim as my improvement, is the arranging of the stanchions in a vibrating frame, to accommodate the position of the animal when lying down

"I also claim the stanchion or fall piece *g*, in connexion with the stay cords, by which means it is brought to an upright position when closing the stanchion *h*, thereby preventing an animal taking the place which is occupied by the stanchion *h* when open.

"I further claim the catch and spring to hold the stanchions in an upright position, in combination with the rope for releasing the cattle from confinement, as specified."

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57. For an *Improvement in the Attachment of Prison Locks;* Edward Kershaw, Boston, Massachusetts, July 30.

*Claim.*—"What I claim as my invention, is the combination of the stud and its recess or hole, or their equivalents, with the cell door opening and the double hinged arm and lock, substantially in the manner and for the purpose of preventing strain on the lock by pressure against the cell door, by a prisoner or person within the cell, as above specified."

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58. For an *Improvement in Attaching Hooks and Eyes to Paper Cards;* Peter Kirkham, Waterbury, New Haven county, Connecticut, July 30.

*Claim.*—"What I claim as my invention, is the indenting or impressing the cards or sheets of paper in such a manner as to retain the hooks and eyes in their proper places upon the card until they can be fastened, in whatever manner they may be finally secured."

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59. For an *Improvement in Churn Dashers;* Joseph Marsh, Petersburg, Menard county, Illinois, July 30.

The patentee says,—"The nature of my invention consists in two convex pieces of tin or other suitable material, perforated and placed on the upright, which, when put in motion, creates a suction of atmosphere through the milk."

*Claim.*—"What I claim as my invention, is the double concave, perforated, discoid churn dasher, as herein described, and for the purposes set forth."

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60. For an *Improvement in Distilling Spirits of Turpentine;* Charles J. Meinicke, City of New York, July 30.

*Claim.*—"What I claim as my invention, is the process as described for distilling turpentine, so that the spirits of turpentine are distilled and the rosin saponified, ready for soap making, at one operation."

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61. For *Improved Valve Gear for Steam Engines;* George B. Milner, Houston, Harris county, Texas, July 30.

The patentee says,—"The nature of this invention consists in attaching the end of the connecting rod, which operates the valves for admitting steam to the cylinder, to the centre of a transverse traversing bar or lever, attached by bolts at its extremities to parallel sliding rods, one of which operates the escape valves, and both being provided with square frames at their ends, surrounding D-shaped cams or eccentrics secured on the main shaft, one of which is made movable and provided with a segmental slot through which is passed a bolt, so as to enable said cam or eccentric to be secured in such relation to the other cam or eccentric as to cut the steam off when the piston has reached any desired point in its stroke, and to cause

the steam admitted to the cylinder to expand and exert its force on the piston the remainder of the stroke."

*Claim.*—"What I claim as new, is the combination of the fixed cam, with its frame and rods, and the adjustable cam, with its frame and rods, to which latter are attached the traversing and oscillating bar, having secured to one end of it the rod *g*, and at or near its centre the rod H, which actuate respectively the eduction and induction valves, substantially in the manner herein described, forming together a simple valve motion, and one which enables the engineer to regulate the degree of cut off at will."

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62. For an *Improvement in Rubbing and Polishing Stone;* Adrian Olcott, Millstone, Somerset county, New Jersey, July 30.

The patentee says,—"The nature of my invention consists in a new arrangement and method of securing and holding blocks of stone upon a rubbing bed, for the purpose of facing them, the blocks being placed and held in such manner that they are continually moved about on the bed over the whole surface, wearing it equally in all parts, so that it remains perfectly level, and produces a corresponding flat and true surface to the stone."

*Claim.*—"What I claim as my invention, is attaching the stone to be faced to a chain, one end of which is attached to a windlass, by which it may be lengthened or shortened, the stone being left free, so as to be continually changing its position on the bed during the operation of rubbing, by which an uniform and even wear is produced on the bed, and a true face given to the stone, in the manner substantially as described."

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63. For an *Improvement in Atmospheric Churns;* John O'Neil, Xenia, Greene county, Ohio, July 30.

*Claim.*—"What I claim as my invention, is the construction of the air tube in combination with the plungers and partition, as set forth, whereby the cream is thoroughly agitated and intimately mixed with atmospheric air, by forcing it alternately to the opposite sides of the partition through branches of the air tube, as set forth."

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64. For a *Jigger Windlass;* Charles Perley, City of New York, July 30.

*Claim.*—"I claim as new, 1st, the application of the double acting pawls, ratchet, disk, socket, and handspike, with or without the winch-head, whereby the power is applied to the horns to rotate them in either direction, as required; said application and arrangement being a combination of the double acting winch, described in my patent of 29th May, 1849, and the cable-lifting horns described in my patent of 21st March, 1848, heretofore referred to, whereby this combination of these two previously patented inventions effects new and useful purposes, not contemplated and not attainable by either of the inventions separately, substantially as described."

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65. For *Improvements in Apparatus for Sizing and Drying Cotton Batting;* Elias P. Rider, City of New York, July 30.

*Claim.*—"What I claim as my invention, is, 1st, doubling and turning the ragged and uneven edges of the bat of cotton as it comes from the carding engine, and pressing them down to form a smooth selvage, as set forth, by means of the curved plates in combination with the cylinders, as described, or other equivalents.

"2d, I claim heating and ironing the surface of the bat of cotton previous to being glazed, for the purpose set forth, whether performed by the means herein described or other equivalent means.

"I likewise claim making the floating cylinder with check rings or their equivalents, in the manner and for the purpose described.

"I claim passing the bat through a space between the floating cylinder and compressive cylinder, and imparting the sizing to the bat of cotton without pressure, as described.

"I claim making the drying chamber a double inclined plane, in combination with the chimney constructed as aforesaid, for the purpose of increasing the circulation.

"I also claim the peculiar combination of the heating, selvaging, ironing, and glazing, and drying apparatus, by which the bat of cotton, as it comes from the carding engine, is selvaged, ironed, glazed, and steam-dried by a continuous process, as herein fully set forth, the sizing vat being placed directly beneath the compressive cylinder, so that the sizing can be introduced fresh from the vat to the bat as it comes from the ironing cylinder, as described."

66. For an *Improvement in Purifying Coal Gas;* Joseph A. Sabbaton, Albany, New York, July 30.

The patentee says,—"My improvement consists in that, instead of using lime alone, I use a mixture of lime and coke dust, (technically called 'breeze,' an article now thrown away as useless,) or in its stead charcoal dust or any other substance of that nature, the object being thereby to produce a separation of the particles of lime, by which means a greater number of them are exposed to the action of the gas; and besides this mechanical action, the carbonaceous matter exerts a chemical action on the ammonia and other impurities contained in the gas, and separates them from it."

*Claim.*—"What I claim as my invention, is the mixture with coke dust or 'breeze,' charcoal dust, or other carbonaceous substance, for the purposes of acting mechanically in the separation of the particles of lime, and at the same time acting chemically in removing various impurities from the gas, which cannot be separated by the ordinary methods of purifying gas, substantially as above set forth."

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67. For an *Improvement in Connecting Hubs with Axles;* Eliphalet S. Scripture, Green Point, Kings county, New York, July 30.

*Claim.*—"What I claim as new, is the application of the half-boxes with the semi-circular lip and rib, constructed to enter the grooves near the end of the axle box, said boxes being secured together and connected to the axle bar by any competent means, and said ribs, grooves, and boxes operating as a substitue for a collar on the axle, and to hold the axle box and wheel on the axle, and also to keep dust out of the parts, substantially as described."

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68. For an *Improvement in the Arrangement of Pressure and Feed Rollers in Planing Machines;* Charles A. Spring and Peter Boon, Kensington, Philadelphia county, Pennsylvania, July 30.

The patentees say,—"The nature of our invention consists in placing a cylinder of knives, constructed on any of the most approved plans, in an oblique position, say at an angle of 45°, more or less, with the line of motion of the board through the machine.

"We also construct the bed of the machine so that it may be moved to or from the knife, which allows it to be set to plane boards of any thickness, or to move it back from the planing cylinder if required."

*Claim.*—"What we claim as new, is connecting the movable weighted pressure rollers with the stationary ones by oblique links, in combination with the additional rollers, the whole arranged substantially in the manner and for the purposes set forth."

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69. For *Improvements in Machines for Forming Tubes of Sheet Metal;* Joseph Stout and James T. Stanton, Waynesville, Warren county, Ohio, July 30.

The patentees say,—"The nature of our invention relates to such arrangements of machinery heretofore in use, as have a roller around which a metallic candle mould or other tube is formed, which can be easily detached from the machine in which it works, so as to admit the tube formed on it to be slipped off at one end, instead of having to be sprung open and thrown out of a round form. And also having spring bearings for the rollers, thus enabling them to adjust themselves to the thickness of the material used in them."

*Claim.*—"What we claim as our invention, is supporting the forming roller upon the short ends of the bent levers, in combination with the upper roller supported by springs, substantially in the manner and for the purposes herein described."

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70. For an *Improved Bolt and Rivet Machine;* William E. Ward, Port Chester, Westchester county, New York, July 30.

The patentee says,—"The nature of the first part of my invention consists in gauging the length of the shank to be cut off after the head has been formed, by feeding in a rod against a rest beyond the blades, which has a lateral movement to permit the head to pass by it, and, by the operation of cutting off the shank, determining or gauging the length of wire which shall project beyond the dies to form the next head.

"And the last part of my invention consists in cutting off the length of the shank by the return lateral motion of the header, in combination with the movable rest."

*Claim.*—"What I claim as my invention, is, 1st, gauging the length of the shank after a head has been formed on the end, by pushing the head against a gauge beyond the header,

which has a lateral motion to allow it to pass by, substantially as described, in combination with the operation of cutting off the shank at such distance from the griping dies as, by the same operation to determine or gauge the length of rod or wire which shall be left projecting beyond the griping dies for forming the next head, substantially as described.

"And lastly, Cutting off the rod or wire, after the head has been formed, by the return lateral motion of the header, in combination with the rest, substantially as described, the edges of the rest and heading die being formed to answer the purpose of shears, as herein described."

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71. For an *Improvement in Car Seat Backs;* Thomas E. Warren, Troy, New York, July 30.

The patentee says,—"The nature of my invention consists in forming the back of spring sheet iron, or any other suitable metal, the same extending along two or more seats on the same base; the back is in a curved form for each seat; by this mode they are rendered cheap of construction, and give ease to the sitter in consequence of the form given to them to constitute the spring."

*Claim.*—"What I claim as my invention, is the forming of the backs of car seats of double curved plates of metal attached by the ends to the arms of the seat, made to embrace both sides of the end pieces to which they are pivoted, and on which the car seats are reversed, formed, stayed, and braced substantially in the manner and for the purpose herein specified."

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72. For an *Improvement in the Countertwist Speeder;* Jesse Whitehead, Manchester, Chesterfield county, Virginia, July 30.

The patentee says,—"My improvement relates especially to serrating the sides of the groove in the revolving shaft, so that the roving may be drawn from the twisting band by said shaft instead of having to rely upon the draft of the bobbin, in combination with the effect produced by the increased diameter of the portions of the shaft from which the bobbin receives its motion, thereby winding the roving upon the bobbin without producing an undue draft on the roving between the shaft and the twisting band, the serrated groove holding the roving and preventing it from slipping whilst the requisit draft is imparted to it in the space between the groove and the bobbin, which will cause the roving to be wound upon the bobbin in a compact state, and diminishing the danger of breaking.

"Also in the employment of a certain pendant arm and spring, the former attached to one of the arms that hold the bobbin, and the latter to the carriage, for the purpose of preventing the dancing or rapid vibration of the bobbin upon the shaft as the bobbin fills, by which the roving is made uneven and frequently broken."

*Claim.*—"What I claim as new, is making the shaft with a serrated groove, in combination with the reduced portions of the shaft adjacent to said groove, wherein the roving runs from the twisting band to the bobbin, in the manner and for the purpose set forth.

"I also claim the combination of the spring and pendant tapered arm with the vibrating bobbin arm, arranged and operated in the manner and for the purpose herein set forth, or in any other way which may be considered substantially the same, and by which analogous results shall be produced: that is to say, any arrangement wherein a rubbing pressure is imparted to the arms, or their equivalents, containing the journals of the bobbin for producing the effect herein stated; said arrangement preventing the sudden rebounding of the bobbin on the shaft, when it becomes uneven from any cause which the mere spring and weight applied to the bobbin axle or its arms will not prevent, as I have fully tested by experiment,—the spring, when used alone, being too elastic, and the weight too dead, whereas the combination of the two causes the bobbin to rise and fall gradually, as herein fully set forth."

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73. For an *Improvement in Fastenings for Bureau Drawers;* George Wode, Elizabethport, Essex county, New Jersey, July 30.

The patentee says,—"The nature of my invention consists in so constructing the drawers of a bureau or other piece of cabinet furniture, that when all are closed but the topmost one, the shutting of that will cause all the others to be locked in that closed position, so that no one of them can be opened until the topmost one is partially withdrawn."

*Claim.*—"What I claim as my invention, is, 1st, the metallic strip or its equivalent, constructed with the notch for receiving the fastening bolt, as set forth.

"2d, The locking bolt, operated by the opening or closing of any one of the drawers, for the purposes herein named; the whole being constructed substantially in the manner herein set forth."

DESIGNS FOR JULY, 1850.

1. For a *Design for Stoves;* Johnson & Cox, assignees of Joshua Crandall, Troy, New York, July 2.

*Claim.*—"What I claim is the design of cook stove represented in the drawings."

2. For a *Design for Stoves;* Calvin Doane, Braintree, Norfolk county, Massachusetts, July 9.

*Claim.*—"What I claim is the ornamental design herein described, for the front and back plates of a horizontal cylindrical air tight, and the door of the former consisting of scallop shells and razor shells, cast in alto relievo in the several positions on said plates specified and represented in the drawings."

3. For a *Design for Lamps;* Ellis S. Archer and Redwood F. Warner, Philadelphia, Pennsylvania, July 9.

*Claim.*—"We claim the ornamental design of the column or pedestal, the oil cup, and the border round the globe holder, set forth in the accompanying drawing, as our original design."

4. For a *Design for Stoves;* Sherman S. Jewett and Francis H. Root, Buffalo, New York, July 9.

*Claim.*—"What we claim is the shape and configuration of the ornamental plates for stoves herein described."

5. For a *Design for Stoves;* A. C. Barstow & Co., assignees of Apollos Richmond, Providence, Rhode Island, July 16.

*Claim.*—"What I claim, is ornamenting the several mouldings of the top and bottom of a pyramid stove, and the double doors resting on the latter, with transverse, longitudinal, and clustered beak-heads, cast in alto relievo, as described and represented in the drawings."

6. For a *Design for Stoves;* James McGregor, Wilton, New York, assignee of J. H. Conklin and A. W. Jones, City of New York, July 22.

*Claim.*—"We claim the design which is fully set forth in the drawings accompanying this description."

7. For a *Design for Stoves;* Job E. Owens, Jacob Ebert, and Elbridge G. Dyer, Hamilton, Butler county, Ohio, July 22.

*Claim.*—"What we claim, is the combined ornamental design and configurationof plates for a cooking stove, substantially as herein set forth, and represented in the accompanying drawings."

8. For a *Design for a Portable Grate;* Amos Paul, South New Market, Rockingham county, New Hampshire, July 22.

*Claim.*—"What I claim is the new design herein described, for the front plate of a portable grate, consisting of the five-centred arch moulding, supported by the triple column pilasters, in combination with the gothic panels on each side of said pilasters, and three-sided panels on the horizontal part of the frame; said three-sided panels, and the space beneath the arch moulding, being filled with the wedge-shaped radial ribs, all as herein described."

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*List of American Patents which issued in August,* 1850, *with Exemplifications by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in the Manufacture of Raw Hide Whips;* Thomas J. Barnes, Lowell, Massachusetts, August 6.

*Claim.*—"What I claim as my invention, is the described improvement in the manufacture of whips, or a whip having its external covering, as well as it Turks' heads or buttons, made in whole or in part of corrugated strips or bands of raw hide, laid or woven together, and on the handle or stock, substantially as specified."

2. For an *Improvement in Scrapers used by Cabinet Makers;* Hiram Carver, Edinburgh, Shenandoah county, Virginia, August 6.

*Claim.*—"What I claim as my invention, is the scraper stock, set in a frame for holding and guiding the scraper, so that the forward end only of the frame shall rest on the surface to be scraped, and thereby enabling the workman to manage the tool with the whole hand, and apply a steady force, instead of using the fingers only, as heretofore, for that purpose.

"2d, I also claim reversing the position of the scraper-stock, and plate in the stock-frame, whereby I am enabled to use both feather edges or corners of the plate successively without taking the plate from the stock, as set forth."

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3. For an *Improvement in Seed Planters;* Edson Hart, New Albany, Floyd county, Indiana, August 6.

*Claim.*—"What I claim as new, is the combined operation of filling and discharging the revolving cups or cavities in the planting rollers by a single blow of the arms on the said rollers, substantially as set forth."

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4. For an *Improvement in Ballot Boxes;* John R. Cannon, Hiltonsville, and Abner Hobbs, Greensburg, assignees of Joseph A. Hill, Bloomington, Monroe county, Indiana, August 6.

*Claim.*—"What I claim as new, is the arrangement substantially as described, of a moving band or tape, imprinted with numerals, and actuated by pedals, ratchet movement, and rollers, or other equivalent device, in connexion with spring detention latches and a liberating brake, or their equivalents, so that while the number polled for each respective candidate is exhibited by the appropriate tape, each pedal, as it is brought into play by the voter, is detained by its respective latch until again liberated by the attending officer, thus effectually preventing the duplication of votes."

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5. For an *Improvement in Processes for Amalgamating Gold;* Calvin C. Knowles, Lowell, Massachusetts, August 6.

The patentee says,—"The improvement in the separating process which I have discovered consists in applying to the sand or pulverized quartz, with which the gold is connected or intermingled, a solution of chloride of sodium and tartaric acid in soft water. The chloride of sodium and tartaric acid should be mixed together in about equal proportions, and one ounce of the mixture makes a suitable solution in one quart of water."

*Claim.*—"What I claim as my discovery, is saturating or dampening the sand or quartz with which gold is found with a solution, in soft water, of chloride of sodium and tartaric acid, mixed in about equal proportions, and applied to the sand, &c., prior to the introduction of quicksilver, to effect amalgamation with the gold."

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6. For an *Improved Method of Making Barrels for Fire Arms;* Jesse Pannabecker, Elizabeth township, Lancaster county, Pennsylvania, August 6.

*Claim.*—"What I claim as my invention, is making barrels for fire arms with a double seam or weld, from two bars of metal previously rolled into a semi-circular form; the whole operation being conducted as described."

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7. For an *Improvement in Hanging and Operating Gates;* Thomas Parkinson, Naples, Ontario county, New York, August 6.

The patentee says,—"The nature of my invention consists in a gate of two separate parts of equal size, sufficiently large to fill the required opening, and which are severally opened with the hand, assisted by weights, throwing them over upon an axis placed at the outer lower corner of each half of the gate."

*Claim.*—"What I claim as my invention, is the manner of hanging and operating the gates, substantially as described."

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8. For an *Improvement in Tenoning Machines;* E. M. Shaw, Baltimore, Maryland, August 6.

The patentee says,—"My machine is constructed to cut a tenon, by removing the wood from either or both faces of the piece of wood on which the tenon is to be made, by means

of two reciprocating planes, whose irons are connected in such manner with their respective stocks that they act upon the wood during their direct stroke, while during their retrograde stroke their cutting edges are moved back from the surface from which the shaving has been removed by their direct stroke, thus preventing the edges of the plane irons from being dulled by rubbing or grinding over the surface of the timber in the retrograde stroke of the planes."

*Claim.*—"What I claim as new, are the planes for cutting the tenons, whose irons are made to turn alternately from and towards the faces of their respective stocks, so as alternately to cut and clear the lumber on which they are acting."

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9. For an *Improvement in Churn Dashers;* Robert S. Sherman, Napanock, Ulster county, New York, August 6.

The patentee says,—"My improvements consist in constructing the concave dasher or bottom plate with four or more, inverted funnel-shaped tubes, projecting upward and outward therefrom, at equal distances apart, and concentric to the circle of the concave dasher or bottom plate, there being openings in said concave dasher corresponding with the funnel-shaped tubes; and, in connexion with these tubes, arranging four or more radial wings or plates around the staff of the dasher, whose outer edges are inclined upward and outward directly over the upper or smaller ends of the funnel-shaped tubes, and having a circular cap plate or disk placed over their upper edges, of a circle greater than the circle of the funnel-shaped tubes, by which arrangement, on the descent of the dasher and staff, the cream will be forced upward through the openings in the concave dasher and inclined tubes in streams, against the inclined edges of the radial wings or plates, and divided and deflected, or thrown out, by the cap plate or disk, nearly horizontally against the sides of the churn tub."

*Claim.*—"All that I claim is the combination of the funnel-shaped tubes, radial wings or plates, inclining upward and outward directly over the ends of the tubes, with the circular cap plate or disk, for the purpose as described."

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10. For an *Improvement in Harness Saddles;* Robert Spencer, Brooklyn, New York, August 6.

*Claim.*—"What I claim as my invention, is the combination of separate elastic plates with the skirt portions of the casting and the pads, substantially in the manner set forth, for the purpose of causing the pads to have a springy and equable bearing upon a horse, and to adapt themselves to horses of different sizes and conditions."

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11. For an *Improvement in Machines for Beating Gold;* William Vine and James H. Ashmead, Hartford, Connecticut, August 6.

*Claim.*—"What I claim as my invention, is the combination of the adjustable differential cams with the pendulums, by means of which the packet is shifted under the hammer, so as to regulate the distribution of the blows upon it, as herein set forth."

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12. For *Improvements in Machinery for Dressing Weavers' Harness;* Kassimir Vogel, Westbrook, Cumberland county, Maine, August 6.

*Claim.*—"What I claim as my invention, is the within described combination of the size or glue receptacle and the rotating brushes with each other and with the shafts, the screw shafts, the sliding rod, the lever, the clutch, the pulleys, and the driving pulley, by which the brushes are made simultaneously to rotate on their axes, and to alternately traverse from one end of the harness to the other, (or any portion of it,) and deposit the size or glue evenly and smoothly upon the threads of the harness; substantially as set forth.

"In combination with the size or glue receptacle, and the rotating and reciprocating brushes above set forth, I also claim the imparting a reciprocating movement to the frame in which the harnesses are placed, simultaneously with the combined movements of the said brushes, substantially in the manner set forth.

"I also claim the making the sliding frame of such shape and capacity as to receive two sets of harness, when it is combined with the shaft, the pulley, the crank or lever, the elastic lever, the pitman, and the crank wrist, substantially as set forth, by which, without stopping the machine, a dressed harness can be removed from the frame, and an undressed harness secured in its place, whilst another harness is being dressed with size or glue in the opposite receptacle of the said frame, substantially in the manner set forth."

13. For an *Improvement in Churn Dashers;* William and Matthew C. Walker, Lancaster, Pennsylvania, August 6.

*Claim.*—"What we claim as our invention, is the double curved S-shaped dasher, with the grooved pieces in combination, as herein described for the purposes set forth."

14. For an *Improvement in Cooking Stoves;* Jame White, Milton, Northumberland county, Pennsylvania, August 6.

*Claim.*—"What I claim as my invention, is, 1st, the manner of forming the front diving flues on either side of the stove, by recessing the centre of the front plate above and beneath the plate forming the hearth and bottom of the fire chamber, and inserting plates to form the insides of the flues in the fire chamber, so that they can be replaced when burnt out, without disturbing the sections of said plates below the hearth, as described."

15. For *Improvements in Tenon Bitts;* Eli K. Wisell, Warren, Trumbull county, Ohio, August 6.

The patentee says,—"My invention consists of a tenoning tool or bit of peculiar construction, which is adapted to an ordinary boring brace, and is composed of converging slides, in combination with a pair of planes, which embrace the extremity of the spoke, and which, as the brace is turned and forced endwise toward the spoke, are caused to approach each other, thus reducing and rounding its extremity until the space between the plane irons is equal to the diameter of a finished tenon, when their closer approximation is stopped by gauges secured to their opposite faces."

*Claim.*—"What I claim as my invention, is the combination of converging slides with a pair of planes, the latter being combined with the former in such a manner that, by pressure and turning, they are caused to approach each other, and reduce the extremity of the spoke to which they are applied, substantially as herein set forth, the slides and planes being turned by a hand brace or by machinery."

To be continued.

## MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

### *Investigation of the Comparative Merits of the Perpendicular and Radial Paddle Wheels for Sea-Going Vessels. By* B. F. Isherwood, Esq., *Chief Engineer, U. S. Navy.*

Continued from page 139.

Let us suppose, now, the same depth of immersion for the radiating paddle wheel, whose arm, as before, with a radial paddle at its extremity, is just entering the water at an angle of 45°, and having, as before also, the same less horizontal velocity than the velocity of the vessel. There is now no loss of reactionary force, but there is the loss by oblique action; and as the angle is 45°, it follows that half the force applied to the paddle is expended in lifting the vessel. This result, however, as with the perpendicular paddle, is too minute to be appreciable. The proportion, now, of this lifting force to the total power applied to the paddle under consideration, is 50 per cent.—with the perpendicular paddle 25 per cent., to which must be added 25 per cent. by reactionary loss. Hence there would be no superiority, economically, of the particular perpendicular paddle under consideration over the radial paddle, at this maximum immersion, in practice; but they would exactly equal each other, supposing, of course, the same horizontal velocity for each, and that horizontal velocity equally less than the velocity of the vessel.

This equality of loss is true, however, but of three positions of the paddles, viz., when the arm carrying them is either horizontal or vertical, or intermediate: that is, at 45°. In the first case, the wheel would be immersed to its axis; then, the radial paddle coinciding with the arm, all the power applied to it would be expended in vertical pressure only; and the perpendicular paddle at right angles to the arm, would cause a loss of the whole reactionary force applied to it. In the second case, both paddles would expend the whole power applied to them in the propulsion of the vessel. In the last case, as has already been shown, the loss of reactionary and lifting force by the perpendicular paddle, and by oblique action of the radial paddle, is equal, and amounts in both to 50 per cent. But this equality does not exist at any point between the angle of 45° and a horizontal and a perpendicular position, and this results from the fact that the loss of labor by reaction and lifting, is in proportion to the *sines* of the angles, while the loss by oblique action is in proportion to the *squares* of the same sines.

Supposing, now, the purely imaginary case where the vessel has a greater velocity than the horizontal velocity of the paddle having the greatest horizontal velocity, and the wheel to be immersed to its axis; we should then have the following losses by the two kinds of paddles, calculating the reactionary and lifting loss by the perpendicular paddle as the sines of the angles, and the oblique action loss by the radial paddle as the squares of the sines of the same angles,—supposing the arms of the two wheels the same in number, and to be in corresponding positions.

| Angle of arm with surface of water. | PERPENDICULAR PADDLE. Loss by reaction and lifting. | RADIAL PADDLE. Loss by oblique action. | Difference in favor of perp'r paddle. | Difference in favor of the radial paddle. |
|---|---|---|---|---|
| | per cent. | per cent. | per cent. | per cent. |
| 0° or horiz'tl. | 100 | 100 | 0 | |
| 5° | 92 | 99 | 7 | |
| 15° | 79 | 93 | 14 | |
| 25° | 68 | 82 | 14 | |
| 35° | 59 | 66 | 7 | |
| 45° | 50 | 50 | 0 | 0 |
| 55° | 41 | 34 | | 7 |
| 65° | 32 | 18 | | 14 |
| 75° | 21 | 7 | | 14 |
| 85° | 8 | 1 | | 7 |
| 90° or perp'lar | 0 | 0 | | 0 |
| Totals, | 450 | 450 | 42 | 42 |

In the above supposed case, then, we perceive there would be no choice between the two kinds of paddles, as they operate equal losses,—the sum of the losses of each being equal and expressed by the number 450. Moreover, we perceive that, in going from 0° to 45°, the losses by the perpendicular paddle are less than by the radial paddle by the number 42; and that, in going from 45° to 90°, the losses by the radial paddle are less than by the perpendicular paddle by the same number, 42; further, that at midway between 0° and 45°, and 45° and 90°, the difference is at its

maximum. Our supposed case is wholly an impossible one, but is adduced to explain the different actions of the two kinds of wheels. Practically, we must confine ourselves to the consideration of the mean case, where the wheels have an immersion of $5\frac{1}{2}$ feet, and a slip of 20 per cent.

Referring now to our wheel of 28 feet diameter, $5\frac{1}{2}$ feet immersion, and 20 per cent. slip, the paddles would begin to enter the water when the arm bearing them made an angle of about 35° with the surface of the water, and would come into propelling action when the same arm made an angle of about 50° with the surface of the water. How would the proportion of losses by the two kinds of paddles now stand?

Premising that the loss by oblique action begins when the radial paddle enters the water, and continues till it reaches a vertical position, and that the reactionary loss by the perpendicular paddle is confined between the points where it enters the water and where it comes into propelling action, and that the amount of power applied to each *whole* paddle, in each position taken, equals unity or 100, the paddles acting during equal times, and if but a *fraction* of the *whole* paddle act, then the power applied to it will be that fraction of 100; and if the paddles act during unequal times, then the power applied to each will be in the proportion of the time it acts. Now from the angle of 35° to 90° we have taken six positions, in only the last four of which, however, the whole paddle acts during equal times. In the first position only about $\frac{1}{8}$th of the whole paddle acts, and that but for half the times of the others; the power applied to it will then be $\frac{1}{16}$th of 100. In the second position only about $\frac{1}{2}$ of the whole paddle acts; the power applied to it will then be $\frac{1}{2}$ of 100. The whole power applied will therefore be represented by $400+6\frac{1}{4}+50=456\frac{1}{4}$. The reactionary loss obtains for the first and second positions only, and for the first position, (taking the per cents. of loss from the foregoing table,) will be $\frac{1}{16}$th of $59=3{\cdot}7$. For the second position $\frac{1}{2}$ of $50=25$; total, $3{\cdot}7+25=28{\cdot}7$. Then the whole power applied being represented by 456·25, the whole power expended in reaction and lifting will be represented by 28·70, or 6·3 per cent. nearly. The difference in favor of the perpendicular paddle over the radial paddle is therefore $18\frac{1}{3}-6{\cdot}3=12$ per cent. in round numbers. From this 12 per cent. must be deducted the per centage of power absorbed in the friction of the eccentric strap, and journals of the levers of the perpendicular paddle wheel. That per centage of friction can only be determined by experiment. Taking it, however, at 10 pr. ct. we perceive that, with equal slips, viz., 20 pr. ct., which is about the least that it is advisable to give, or is given in practice, and with a depth of immersion of $5\frac{1}{2}$ feet for a 28 feet diameter wheel, which is the maximum mean immersion for the largest steam ships making long voyages, the perpendicular paddle exceeds the radial paddle economically by 2 per cent. If the slip be varied from 20 per cent. so as to become greater, or if the immersion be increased beyond the proportion of $5\frac{1}{2}$ to 14, (the radius of the wheel,) the per centage in favor of the perpendicular paddle will be greatly increased. The only conditions under which a superiority can be given to the radial paddle are those of small immersion and small slip.

The per centage of loss by friction with the perpendicular wheel having been determined, and being allowed for, a simple calculation, similar to that above given, will easily ascertain the relative excellence of the two

kinds of paddles in any given cases, when the slip and immersion of each are known.

I shall now proceed to determine this friction from such data as I am possessed of, on vessels using the two different wheels. For this purpose I have selected two vessels whose performances are given by the English Admiralty at a measured mile in the Thames River. The dimensions of the vessels are as follows:—

| | "Black Eagle." Perpendicular Paddle. | "Trident." Radial Paddle. |
|---|---|---|
| *Hulls.* | | |
| Length on deck, | 155 feet. | 195 feet. |
| Beam " | 26 " | 31 " |
| Depth of hold, | 14 5-6 feet. | 18 " |
| Mean draught of water, | 10½ " | 11 " |
| Displacement, | 600 tons. | 900 tons. |
| Immersed amidship section, | 200 sq. feet. | 252 sq. feet. |
| *Paddle Wheel.* | | |
| Effective diameter, | 20·25 feet. | 20 67 feet. |
| Radius of circle of centre of reaction, | 9·60 " | 9·77 " |
| Radius of rolling circle, | 7·75 " | 7·59 " |
| Breadth of paddle, | 4·17 " | 2·00 " |
| Area of one paddle, | 22·90 " | 18·00 " |
| Immersion of lower edge of paddle, | 4·96 " | 2·08 " |
| *Engines.* | | |
| Number of steam cylinders, | 2 | 2 |
| Diameter, | 62 inches. | 70¾ inches. |
| Stroke of piston, | 4½ feet. | 5 feet. |
| Number of double strokes per minute, | 23¾ | 22 |
| Mean effective steam pressure in the cylinder throughout stroke, | 17 lbs. | 17 lbs. |
| Actual horses power developed by engines, | 665 | 891 |
| Speed of vessel in statute miles per hour, | 13·14 | 11·92 |

The calculations we are about to make, have for their object the determination of the friction of the lever journals, and of the eccentric strap of the perpendicular paddle, in per cents. of the total power developed by the engine. To effect this there must be calculated for the two vessels the losses, (omitting the friction loss by the perpendicular paddle wheel,) by their respective paddle wheels, viz., in the "Black Eagle" by slip and reaction, and in the "Trident" by slip and oblique action. To these must be farther added the power, in per cents., which has been found in practice required to work the engine, and to overcome the friction of the load. The remainder of the power will be considered as that utilized in the propulsion of the vessel. The vessels, however, are of different dimensions, and the power required to propel them at equal speed will be as their resistances multiplied by their respective immersed amidship sections. These resistances will be in the compound ratio of their immersed amidship sections and displacements. The previous remainder of the power being multiplied by these coefficients of resistance inversely, will represent the powers proportionally to the resistances they overcome. The final comparison is now readily made, by taking these proportional powers as the measure of the powers, and the cubes of the speeds of the vessels as the measure of the effects.

If now our data were exactly correct, and there were no loss of labor

by the friction of the perpendicular paddle wheel, the final comparison would show, in each case, the powers to bear equal proportions to the cubes of their respective speeds; assuming the data to be correct, there will remain the loss by friction of the perpendicular paddle wheel included in the final comparison, which will then *not* show the powers to bear equal proportions to the cubes of the speeds, and the discrepancy is the measure of the power absorbed in the friction of the perpendicular paddle wheel.

Let us make these calculations, and first for the perpendicular paddle wheel of the "Black Eagle."

| | | |
|---|---|---|
| Speed of vessel per hour, 13·14 statute miles, or | 69379·20 | feet. |
| Speed of centre of reaction, . . . . . | 85954·18 | " |
| Slip, . . . . . | 16574·98 | " or 19·3 pr. ct. |

Loss by reaction, calculated as before described, between the surface of the water and a horizontal line tangential to the lowest point of the rolling circle, (the circumference of which circle multiplied by the number of revolutions of the paddle wheel equals the speed of the vessel,) is 6·7 per cent. of the total power.

The power required to work the engine, overcome load or air pump, &c., may be taken at 2 lbs. per square inch of steam piston, or, in round numbers, at 12 per cent., the mean effective pressure on the steam piston being 17 lbs. per square inch.

The power required to overcome the friction of the load on the engine, according to the best experiments, is 10 per cent. We then, for the disposition of the power with the "Black Eagle," have the following:

| | Per Cent. | | Actual Horses Pow'r |
|---|---|---|---|
| Slip of the centre of reaction of the paddles, . | 19·3 | or | 128·345 |
| Reaction of water on the paddle, . . . . | 6·7 | or | 44·555 |
| Working engine, &c., &c., . . . . | 12·0 | or | 79·800 |
| Overcoming friction of load, . . . . | 10·0 | or | 66·500 |
| Utilized in propelling vessel, including amount absorbed in friction of working parts of wheel, . . | 52·0 | or | 345·800 |
| Totals, . . . . | 100·0 | or | 665·000 |

The disposition of power with the "Trident" being calculated as follows, viz., the slip as the difference of speed between the centre of reaction of the paddle and the velocity of the vessel, and the loss by oblique action as the squares of the sines of the angles under which the paddle presses the water, from the surface of the water to a perpendicular position, and the mean taken; and the same allowance for working the engine, overcoming friction of load, &c., being made as for the "Black Eagle," we have:

| | Per Cent. | | Actual Horses Pow'r |
|---|---|---|---|
| Slip of the centre of reaction of the paddle, . . | 22 | or | 196·02 |
| Oblique action of the paddles, . . . . | 8 | or | 71·28 |
| Working Engine, &c., &c., . . . . | 12 | or | 106·92 |
| Overcoming friction of load, . . . . | 10 | or | 89·10 |
| Utilized in propelling vessel, . . . . | 48 | or | 427·68 |
| Totals, . . . . | 100 | | 891·00 |

The coefficients of resistance for the hulls will be obtained as follows: The vessels having about the same proportions between length and beam,

their resistances (that is, the relative resistances of their models) may be considered as their displacements and immersed amidship sections. That this proportion gives the relative resistances of the vessels in function of model (not *absolute* resistances) is easily proven.

Suppose two vessels with the same proportions between length, breadth, and depth, and having the same models, but the immersed amidship section of one is 100 square feet, and its displacement 500 tons; the immersed amidship section of the other is 300 square feet, and as the models are alike, its displacement will have the same proportion to the displacement of the other as its immersed section has to the immersed section of the other: that is, as 3 to 1. The comparison of the relative resistances of these vessels in function of model will then be thus: 100 : 500 :: 300 : 1500, and $100 \times 1500 = 500 \times 300$;—that is, the resistances in function of model are the same, and the immersed amidship sections being as 3 to 1, the absolute resistance will be in the same proportion; because the immersed amidship sections represent the quantities of water moved, and the relative resistances in function of model, represent the resistances of that water to being moved.

Applying this to the "Black Eagle" and "Trident," we have:

600 : 200 :: 900 : 252, and
$600 \times 252 : 900 \times 200 :: 1{\cdot}00 : 1{\cdot}19$.

To obtain the *absolute* resistances of the vessels, the above resistances in function of model must be multiplied by their respective immersed amidship sections. This product represents relatively the proportions of power required to propel the vessels at equal speed. The immersed amidship section of the "Black Eagle" is 200 square feet,—of the "Trident" 252 square feet; and 200 : 252 :: 1·00 : 1·26, and $1{\cdot}26 \times 1{\cdot}19 = 1{\cdot}50$, and $1{\cdot}00 \times 1{\cdot}00 = 1{\cdot}00$; that is, the absolute resistance of the "Black Eagle," comparatively to that of the "Trident," is as 1·00 to 1·50.

To return now to our calculations, we find that the number of actual horses power required to propel the "Black Eagle," (including the amount absorbed in friction of the working parts of the wheel,) was 345·80, and the number of actual horses power required to propel the "Trident" was 427·68; and multiplying these powers by the coefficients of the resistances of the vessels inversely, we have $345{\cdot}80 \times 1{\cdot}50 = 518{\cdot}70$ or 1·0000,
and $427{\cdot}68 \times 1{\cdot}00 = 427{\cdot}68$ or 0·8245.

These last numbers represent the powers proportionally to the resistances they overcome. But they overcome these resistances at different speeds, viz., the "Black Eagle" at 13·14 statute miles per hour, and the "Trident" at 11·92 statute miles per hour. Now powers compare as the cubes of the speeds of the resistances they overcome, $13{\cdot}14^3 : 11{\cdot}92^3 :: 1{\cdot}000 : 0{\cdot}7466$. We have, therefore, for the final comparison,

| | "Black Eagle." | "Trident." |
|---|---|---|
| Powers, | 1·000 | 0·8245 |
| Effects, | 1·000 | 0·7466 |

And 82·45 : 7466 :: 1·000 : 0·9055.

That is to say, the result of the application of the power in the "Black Eagle" is better in the proportion of 1·0000 to 0·9055 than in the "Trident," according to the calculation, and the calculation includes as utilized power, in the "Black Eagle," the power necessarily absorbed by the friction of

its perpendicular paddle wheel. But as allowance for the different resistances of the hulls has been made, the discrepancy in the calculation is produced by, and is equal to, the power absorbed in this friction, and this discrepancy is 1·0000 — 0·9055 = 0·0945, and 0·0945 is $9\frac{45}{100}$ per cent. of the total power, 1·0000, of the "Black Eagle;" $9\frac{45}{100}$ per cent. of the total power is, therefore, the loss by friction of the perpendicular paddle wheel of the "Black Eagle."

Assuming this to be correct, let us see if it will give the same result, making the comparison in another manner, viz., by per cents. utilized of the total power. Taking the total power in each case as unity, or 100·00, we have for the "Black Eagle" the following losses, viz., by slip 19·3, reaction 6·7, working engine 12, friction of load 10, and friction of wheel 9·5; total 57·50, which, deducted from 100·00, leaves 42·50 per cent. utilized. With the "Trident" we have the following losses, viz., slip 22, oblique action 8, working engine 12, and friction of load 10; total 52, which, deducted from 100, leaves 48 per cent. utilized, and 48 : 42·5 :: 1·0000 : 0·8854, or nearly the same proportions as before, which were 1·0000 : 0·9055. The calculation may, therefore, be considered as very nearly correct.

It will be observed that the per cents. of power utilized in the "Black Eagle" were only 42·5, while in the "Trident" they amounted to 48; but the paddles of the "Trident" were only *awash:* that is, having the upper edge coinciding with the surface of the water, an arrangement not practicable for a sea-going vessel. Supposing the paddle of the "Trident" to have had a sea-going immersion: that is, about $\frac{4}{10}$th of the radius of the wheel, and to have had such a surface as to have made the slip the same as for the "Black Eagle," viz., 19·3 per cent., the oblique action in that case would have amounted to $18\frac{1}{3}$ per cent. If, now, to these losses be added those by friction of load, 10 per cent., and working engine, 12 per cent., we shall have a total of 59·6, which, deducted from 100, leaves 40·4, which is an inferiority of 2 per cent. Beside this 2 per cent. economically, there is the important advantage that the perpendicular paddle wheel would have—less bulk and weight; and the bulk and weight can be still further reduced by increasing the slip, and consequently decreasing the loss by reaction.

The loss by reaction amounted to 6·7 per cent. Let us now increase the actual slip, 19·3, making it 25 per cent. With this slip the reactionary loss would be about 2·8 per cent., to which add the 25 per cent. slip, 10 per cent. for friction of load, 12 per cent. for working engine, and 9·5 per cent. for friction of wheel's eccentric strap and levers' journals, and and we have a total of 59·3, which, deducted from 100, leaves 40·7 per cent utilized, almost exactly the same as utilized with a radial paddle wheel of 19·3 per cent. slip, and a loss of $18\frac{1}{3}$ per cent. by oblique action, being the loss normal to a sea-going immersion.

With these proportions of losses, we perceive the two kinds of paddle wheels are economically equal, but there remains a great practical superiority in favor of the perpendicular wheel from its greater slip, viz., its still greater reduced bulk and weight normal to the increased slip; and as this reduction in its paddle surface can be made wholly in the direction of

length, its practical value is of high importance. Let us ascertain the amount of this reduction.

Premising that the propelling efficiency of propelling surfaces is as the squares of the speeds with which they strike the water; and supposing a certain speed of vessel to be given with a certain propelling surface, 1·00, having a velocity of 1·00, and a slip of 19·3; now what amount of surface would be required to propel the vessel at the same velocity but with a slip of 25? Supposing the centre of reaction of the paddle wheels to be of equal diameters, it is evident that the number of revolutions to give the vessel equal speeds with the unequal slips, 19·3 and 25, will be as the slips. The velocities of the propelling surfaces will therefore be as 19·3 and 25, or as 1·0 to 1·3, the squares of which are 1·00 and 1·69. Then 1·69 : 1·00 :: 1·00 : 0·59; that is, there would only, with the 25 per cent. slip, be required $\frac{59}{100}$ of the paddle surface required for the 19·3 per cent. slip, and this reduction being made in the length of the paddle, would reduce the length of the "Black Eagle's" paddle from $5\frac{1}{2}$ feet to $3\frac{1}{4}$ feet,—a very valuable practical result.

A practical advantage resulting from increased slip, is that the same engine can develop a greater power, and give the vessel a greater speed, or a less engine develop an equal power. The saving is obviously in the first cost of engine, and in its less bulk and weight in the ship. We should, therefore, give all the slip possible, *keeping the sum of the losses a minimum*. If increased slip be given without its reducing in a nearly equal degree some other loss, its advantages are obtained at a waste of fuel equal in per cent. to the increase of slip.

Our general conclusion is, then, that for sea-going vessels of medium size and a 9 days' voyage, the perpendicular paddle wheel possesses decided advantages over the radial paddle wheel, both economically, potentially, and in view of the practical advantages of less strain upon the machinery and ship,—less weight and more equable action.

*Washington, July* 5, 1850.

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Translated for the Journal of the Franklin Institute.

## *On Malleable Brass.* *By* Dr. L. Elsner.

It is known that common brass, containing from 27·4 to 31·8 per cent. of zinc, and from 71·9 to 65·8 per cent. of copper, is not malleable while hot, but that articles of it must be made by casting. As it would be of great importance in many branches of industry to have an alloy of this kind that could be worked while hot, like malleable iron, the information that such an alloy exists must be welcome to artists. As far as I know, the first specimens of malleable brass came from England to Hanover, and the first account of the analysis of this alloy was published by the *Gewerb-Verein* of Lower Austria, at Vienna. The results gave a composition of 34·76 zinc and 65·03 copper, with traces of lead.

On the basis of this analysis M. Machts, proprietor of a manufactory, made larger specimens of the alloy in question, and found that, by melting together 33 parts of copper and 25 parts of zinc, there was a loss of three parts; thus making 60 per cent. copper and 40 per cent. zinc. It differs

from the English specimens by containing a larger proportion of zinc, and possesses, according to M. Machts, the precious property of malleability in a higher degree than the English specimens.

A piece of "*yellow metal*," similar in color to this alloy, was found, on analysis, to contain 60·16 copper and 39·71 zinc, which is the composition of malleable brass. It also showed great density or solidity.

I caused an alloy to be made by melting together 60 parts copper and 40 parts zinc, which had the following properties: The color was between that of brass and tombac, it had a strong metallic lustre, a fine, close-grained fracture, and great solidity, (density.) Its specific gravity at the temperature of 10° Celsus, was 8·44;—by calculation it should only have been 8·08, thus showing that in the formation of the alloy a condensation must have taken place. Calculation shows that the alloy may be considered as a determinate chemical combination, for the results of the analysis very nearly accord with the assumption that it may be considered as composed of 3 atoms by weight of copper, and 2 atoms by weight of zinc, (3 Cu + 2 Zn.) The hardness of the alloy is the same as that of fluor spar; it can be scratched by apatite, (glass,) consequently its hardness is = 4. The alloy is harder than copper, very tough, and is, in a properly managed fire, malleable; so much so that a key was forged out of a cast rod.

These important properties of this alloy warrant an expectation of its application to many purposes in the arts, and it would appear that they depend on its definite chemical proportions. Agreeably to the directions of M. Feyerabend, care must be taken in melting together the metals, not to permit too great a loss of zinc to take place, lest the proportion between the metals should be altered, which might not be without effect on the important properties of the alloy. With this view, it might be advantageous in practice, in place of zinc, to add, in melting, proportionate mixture of brass to the proper proportions of copper. An alloy prepared in this way gave, on analysis, 61·44 copper and 38·15 zinc. It is very probable that malleable brass will hereafter, in many cases, be made use of instead of the higher priced copper.—*Verhandlungen des Vereins zur beförderung des Gewerbfleisses in Preussen*, 1849.

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For the Journal of the Franklin Institute.

## *The Koechlin Turbine.*

The hydraulic motor known by this title, and mentioned in this Journal, *Vol.* IX., *3d series*, *p.* 222, has just been introduced in this vicinity by Mr. E. Geyelin, at the powder works of the Messrs. Dupont, near Wilmington, Del.; and at his request, a trial was recently made by certain members of the Institute, to determine the practical coefficient of the wheel. We now propose, for the benefit of those interested, to report the results to the readers of the Journal.

The turbine experimented upon is intended to produce 7 horse power under a fall of 10 feet, and to drive the machinery of the new mixing mill at the lower works. It is $21\frac{1}{4}$ inches in diameter, $3\frac{1}{2}$ inches deep, and is to make 190 revolutions per minute, giving $63\frac{1}{3}$ revolutions of a horizontal

shaft to which it is geared 3 to 1. To this shaft was attached a Prony dynamometer, whose lever was 7·96 feet long, giving 50 feet circumference. At the time of the experiments, a wooden box, nearly water-tight, was placed in the tail race, surrounding the lower part of the wheel. One side of it was cut away, forming a waste-board 3·83 feet wide, over which the water was discharged; and at the same time diminishing the usual head and fall about 9 inches.

*Experiment No.* 1.—The distance between the level of water in the penstock or forebay, and that of the bottom of the waste-board, was 10′ 1″, and the depth of water flowing over the waste-board $8\frac{1}{8}''$, leaving the actual head and fall $10'\cdot1'' - 8\frac{1}{8}'' = 9'$, $4\frac{7}{8} = 9\cdot34$ feet. By Morin's formula, (*Aide Memoire, p.* 37,) $Q = m\,L\,h\,\sqrt{2\,z\,h}$; Q being discharge per second, $m$ the constant which, for ·74 depth, = ·383, L = width of waste-board, = 3·83 feet, and $h$ = depth of water upon it, = ·74. Then in this case $Q = \cdot383 \times 3\cdot83 \times \cdot74\ \sqrt{64 \times \cdot74} = 7\cdot468$ cubic feet, and the theoretical power due to the water was $7\cdot468 \times 62\cdot5 \times 9\cdot34 \times 60 = 261{,}537$ lbs. raised 1 foot per minute = 7·92 horse power.

It was found that, at 63 revolutions per minute of the horizontal shaft, 63 lbs. balanced the lever. Hence the power developed by the wheel was $63 \times 63 \times 50 = 198{,}450$ lbs. = 6·014 horse power.

*Experiment No.* 2.—The gates from the head race were so far closed as to reduce the head 1 foot, and maintain it at that level during the experiment. The depth of water on waste-board was $8\frac{1}{8}''$, so that the head and fall was $9'\cdot1'' - 8\frac{1}{8}'' = 8'\cdot4\frac{7}{8}'' = 8\cdot41$ feet. Therefore, by the same formula, $m$ being ·39 for this depth, $Q = \cdot39 \times 3\cdot83 \times \cdot677\ \sqrt{64 \times \cdot677} = 6\cdot66$ cubic feet, and the theoretical power due to the water was $6\cdot66 \times 62\cdot5 \times 8\cdot41 \times 60 = 210{,}000$ lbs. raised 1 foot per minute = 6·36 horse power.

It was found that 63 lbs. balanced the lever at 49 revolutions per minute of the shaft. Hence the power developed by the wheel was $49 \times 63 \times 50 = 164{,}350$ lbs. = 4·98 horse power.

The coefficients are then, for Experiment No. 1, $\frac{6\cdot014}{7\cdot92} = .760$ per ct.

Experiment No. 2, $\frac{4\cdot98}{6\cdot66} = \cdot783$ "

And, making allowance for leakage around the waste-board box, which was partially counterbalanced by the friction of the gearing and horizontal shaft, the useful coefficient of the wheel may be taken at 75 per cent., and, as has been seen, remains the same when the wheel is working at 5 horse power, which is but 70 per cent. of its full power.

For the information of those who are not familiar with this wheel, it may be stated that it is placed as near the top of the fall as possible, and revolves within a cast iron pipe leading below the level of the tail race. The "curved guides" are directly *over* the wheel, and may, therefore, be easily reached for cleaning or repair. These curved guides are disposed radially around a hub, curving spirally around it as they descend, in such a manner that any horizontal linear element of a guide is in a radial line drawn from the axis. The buckets of the wheel are similarly curved, but in an opposite direction.

Mr. Geyelin has made another small wheel for the Messrs. Dupont, and is also about to erect two of sixty horse power each for other parties in this vicinity. When they are ready for operation, a committee of the Institute will probably be called upon to examine them more carefully, and make a formal report upon their merits. M.

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Translated for the Journal of the Franklin Institute.

## *On Galvanic Soldering.* *By* Dr. L. Elsner.

By the term "*galvanic soldering*" is understood the junction of two separate pieces of metal by means of metal precipitated by the galvanic current. This experiment of soldering by the wet way has been for some time past recommended in technical journals, while on the other side, it has been asserted that an union of separate pieces of metals by this means could not be effected. In order to make this matter, so important to the arts, clear, I instituted the following experiments, the results of which speak favorably for galvanic soldering.

For carrying on the experiments, a "*bladder apparatus*" was made use of. As exciting fluids, there was used, on the one hand, a concentrated solution of sulphate of copper, with an excess of sulphuric acid, which occupied the exterior vessel; on the other, dilute sulphuric acid, which was contained in the inner portion, which is enclosed by a bladder. The block of zinc was plunged into the sulphuric acid, and a plate of copper parallel with the bottom of the bladder into the solution of sulphate of copper, both metals, of course, being connected by wires. On the plate of copper, which served as the negative electrode, was laid a ring of stout sheet copper, which was cut through at one point, (the distance between the two cut ends might amount to from about the $\frac{1}{4}$ to the $\frac{1}{6}$ of a line.) After several days, during which time the exciting fluids were repeatedly renewed, the space between the cut ends of the ring was found completely filled with precipitated metallic copper. Mr. Knoblandt, the engraver, had the kindness to file a portion of the ring at the spot in which the ring had been cut; moreover, the magnifying glass showed the homogeneous filling up of the cut portion with coherent solid copper.

A second copper ring was divided into two parts, and the two halves, with their cut surfaces placed in apposition, were subjected to the same galvanic action. After several days, the two half rings were found completely united into one ring at their point of contact by solid precipitated copper. In this instance, also, filing a portion of the ring at one of the former points of contact, showed that this space was completely filled and solidly united by perfectly homogeneous precipitated copper. On examining this spot with the glass, the perfect homogeneous connexion of the previously divided portions of the ring was very evident.

A third experiment was made in the following manner: Two rings of stout sheet copper were so placed directly over each other as to form a cylinder, consisting of the two rings; moreover, the rings were surrounded with a strip of tinfoil, and this was painted over with a solution of wax in oil of turpentine, so that both rings were equally surrounded with a conducting mould. The rings, thus arranged, were laid on the copper plate

of the "bladder apparatus," and plunged in the solution of sulphate of copper. After several days, the inner sides of the rings were covered with a deposit of copper, and the points of apposition between both rings filled up with galvanically precipitated copper. The rings were no longer subjected to galvanic action, as but a moderately thick layer of copper was deposited on their inner sides; notwithstanding which, both rings were united into a completely solid cylinder. As a matter of course, the outer shell of tinfoil was removed before a trial was made of the solidity of the galvanic deposit. It is also to be remarked, that the rings, after being for some time in contact (during the galvanic action) with the plate of copper on which they reposed, were so firmly attached by the precipitated metallic copper as to require some application of force to separate them from it. All the experiments were exhibited at the meeting of the Society.

From the communication of the results of the foregoing experiments, it may be stated without any hesitation, that galvanic soldering is available to produce a solid connexion of separate portions of metal. Hence it follows, that the solid combination of separate moulded portions of metal into one entire form or figure, by means of galvanically precipitated metal, (usually copper,) must be practicable. There is reason to believe that a galvanic soldering would be effected by means of concentrated solutions of the salts of gold and silver, as is the case with solutions of the salts of copper. M. Von Hackewitz informed me that he had remarked in his works on a large scale, and also in the galvanic precipitations of silver, that even in these galvanic union of distinct and separate portions had taken place.

In prosecuting the before mentioned experiments, it was observed that when the galvanic action was too strong, and also when the current was too powerful, the negative copper electrodes, as well as the plate of copper and the copper rings resting on it, were covered with a dark brown coating, (as is well known to be the case under similar circumstances in galvanic gilding.) After many fruitless attempts to get rid of this brown coating, it was discovered that it could be easily and perfectly effected by immersing for some seconds, in a mixture of sulphuric and nitric acids, the articles thus coated. This brought out afresh the beautiful red color of the galvanically precipitated copper, and after the articles were thoroughly washed with water, and again subjected to galvanic action, a fresh precipitation of copper took place.

That galvanic soldering must have a practical application, may, in few words, be deduced on theoretical grounds. The articles are electro-negative, while the zinc is positive, consequently they are negative at the opposite points of section: *i. e.* subject to the same electric action; therefore, during the electrolytic decomposition of the metallic salt, (in the above instance sulphate of copper,) the separating electro-positive particles of copper are deposited on both the opposite cut surfaces. Being once deposited on the immersed article, they form with it a homogeneous whole, and they now act negatively on the copper still remaining in the solution, and again metallic copper is precipitated on it. This process will and must continue until the space between the pieces of metal is filled with galvanically precipitated copper, as is proved by experience; for the space between the opposite cut surfaces becomes smaller and smaller, by the deposit on them

of the precipitated copper, and when the deposited particles of metal finally come in contact, the former intervening space is completely filled with copper.

As regards the solidity (the degree of cohesion) of the galvanic soldering, it is the same as that of the galvanically precipitated copper, or in general, that of the precipitated metal; moreover, that the cohesion of the precipitated metal is and must be influenced in proportion to the vigor of the galvanic action is self evident, and precisely the same phenomenon will take place in this case, as has been witnessed in galvano-plastic operations.

In the foregoing experiments the simple or single bladder (diaphragm) apparatus was made use of, although, as far as I know up to this time, any constant element has been employed; but since, by the application of the simple bladder apparatus, the same results have been obtained as by the application of the hydro-electric constant elements, it is a further confirmation of the practical applicability of the galvanic soldering.

M. Philipp states that when a ring, open at one place, is to be galvanically gilt, no deposit takes place at the ends, but that it is thicker, in proportion to its distance from its ends. I have repeated these experiments with bronze rings, (of copper and brass,) and found that the rings were all over completely and uniformly gilt and silvered, and consequently on the opposite ends of the cut portions, which, agreeably to the theory, could not be otherwise.—*Verhandlungen des Vereins zur beförderung des Gewerbfleisees in Preussen, Juli und August*, 1849.

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For the Journal of the Franklin Institute.

## *On the Solar Magnetic Engine.* *By* Wm. W. Hubbell, Esq.

To the Committee on Publications of the Franklin Institute.

Gentlemen,—I send to you for publication, an addition to my specification of the "Solar Magnetic Engine," not included in the copy published in the number for August. Accompanying this, is a statement of deductions made by me, from phenomena exhibited by the engine and previously known astronomical truths.

### *Addition to Specification.*

When only two planetary magnets, opposite each other, are used, they may be permanent magnets; and the solar magnet must then change its poles as they arrive at the points of aphelion and perihelion.

In order to equalize the magnetic density as near as possible, between the repelling planetary magnets and the solar magnet, when all are electro-magnets, the batteries which charge them should be connected, positive with positive, negative with negative.

Another mode of applying the solar magnetic principle to use, by which the planetary magnets are made to imitate the action of the comets: that is, to move around different solar centres, is to take several solar magnets, like the one fig. 1st and 2d, (Plate I.,) and place two, three, four, or more, near to, and within, the circuit of the planetary magnets; the poles of the successive solar magnets being on the one side or end positive, the succeeding one negative, and so on alternating successively, and the

other side *vice versâ;* in this way the planetary magnets must change poles as they respectively arrive at the different solar magnets.

A similar series of solar magnets may also be set outside of the planetary circuit, and act on the same mode; and the number of series of planetary magnets, and solar magnets, may be increased in this manner to any extent constituting a single engine,—observing that the solar magnets of different poles should never be placed within each other's influence, rather letting the attractive power predominate in the planetary magnets in this case; they representing the principle of comets moving about different solar centres, in which latter there should exist sufficient magnetism for neutralization, as the former respectively pass the points of aphelion without the solar influences conflicting with each other.

*Deductions from Experiments.*

On surrounding a solar magnet of six inches diameter, by eighteen equidistant planetary magnets, I found that by charging the solar magnet with magnetism, and leaving the planetary magnets or bodies uncharged by the batteries, the solar magnet would polarize them at the clear distance of one inch, (a greater distance I did not try.) This fact convinced me that magnetism diverged from the entire circumference of a solar magnet, similar to the radiation of light from the sun, or any body of light. It is also a known fact that the rays of the sun will, in a few minutes, cause a magnet to be more powerful than it will be when kept for a considerable length of time in the dark, showing that the sun-light is instrumental in the production of magnetism. These facts, together with almost universally known astronomical truths that will be recognized in what I am about to state, lead me to the following superstructure of material law, accounting for the variations and intensity of the magnetic needle; of all which I have no doubt.

In analogy to the solar magnet's polarizing its planetary bodies when not polarized by a battery, I suppose the sun or solar centre to polarize its planets by means of its divergent rays of light; that these rays of light, like the fluid of the solar magnet, diverge strongest at right angles from its axis; that the polar axis of the planets, or focus line of their poles, is always (about) parallel with the solar axis; that the attraction and repulsion existing between the sun and his planets, causing them to approach and recede, and revolve around him, are brought about by the alternate approximation of their poles, owing to the respective oscillating movement of the planets; by means of which, with the earth, (as we say,) the sun passes back and forth between the tropics;—this approximation in the solar engine is produced by changing the planetary poles at the points of aphelion and perihelion by means of the galvanic battery, being another mode of producing alternate approximation of the planetary poles.

My theory, or superstructure of material law, is this: That the sun by means of his rays of light polarizes the planets; and the earth being one of those planets, has, as it rotates on its axis, generated by the light of the sun acting on it, a belt or current of electricity strongest between the tropics, over the torrid zone, which polarizes the extreme parts of the earth, to wit: the north and south poles. Now as the earth oscillates, and the axis or focus line of the poles must be parallel with the axis of the sun, it

is evident that the focus of the poles and the axis of the earth can only be coincident when the sun is, as we say, on the equatorial line of the earth, and that at all other times, the focus of the poles must be moving in an approaching or receding spiral circuit about the axis of the earth; this precise conformity of parallelism of polar focus of the earth with the axis of the sun, would also be governed or influenced by the residuary or permanent magnetism of the earth, from which the attraction and repulsion must ensue in the alternate approximations of the poles to the sun; this would influence the degree of variation of the focus of the poles; but nevertheless true it is, and in accordance with other astronomical truths, that the sun by means of his light polarizes his planets, and that the focus of the poles can only be coincident with their respective axis when he is opposite, or is passing the equatorial line; and that at all other times the focus of the poles is in a spiral circuit, either approaching, or receding from, the axis of rotation of the planets respectively; and as respects the earth, the magnetic needle at sea and elsewhere varies, always pointing to the focus of the poles, governed by that focus, and varying about the axis of the earth's rotation as it varies. Again, as the sun by his light polarizes the planets, and the earth varies in distance from the sun as it traverses its annular orbit, it follows necessarily that the intensity of the poles must change with the change of distance, and that the polarization is strongest when the earth is at its aphelion, and least when at its perihelion. This affects the intensity of the magnetic needle, and also another fact affecting it is, the varying distance of the polar focus, as it moves in its spiral circuit about the axis of the earth.

There is no law or demonstration that I can find to controvert this superstructure of natural law; the known variations of course and intensity of the magnetic needle, or compass itself, go to confirm it.

*Philadelphia, August 10th*, 1850.

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## *Description of a Powerful Magnet.**

Mr. Faraday produced (at a meeting of the Royal Institution) a magnet of remarkable power, to which he invited attention. This magnet was made by Mr. Elias, of Haarlem, and presented to Mr. Faraday by Mr. Logeman, of that city. It weighs 0·98 lb., and lifts 26 lbs., and its power is not diminished on the keeper being forced abruptly from the poles, even though this be done many times in succession. Mr. Faraday reminded the meeting of Haecker's formula, which fixes the greatest sustaining power of the best artificial steel magnets at 10·33 N $\frac{2}{3}$ (N being the weight of the magnet); and he stated that this magnet has twice the power expressed by that formula, and that even when a disk of letter paper is interposed between the poles and the keeper, it will sustain the weight indicated by this formula.

Mr. Faraday mentioned that the small horse-shoe magnet belonging to the Royal Institution weighs 7 lbs. 14½ oz., and lifts from 40 to 41 lbs. (*i. e.*, nearly 10·33 N $\frac{2}{3}$). He concluded by noticing that this magnet of Mr. Elias would support its own weight at a single pole; and in this pro-

* From the London Athenæum, for May, 1850.

perty it resembles the cylindrical bar magnets now made in the electro-magnetic helix, and used in the magnetical observatories. He suggested that this horse-shoe magnet of Mr. Elias might probably be charged by a similar process. These magnets are manufactured in Haarlem at a cheap rate, even when possessing great power.—*Proc. Roy. Inst.*

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For the Journal of the Franklin Institute.

## *Vertical Tubular Boilers.*

The success attending the use of this form of boiler in the steamers "Atlantic" and "Pacific," running from New York to Liverpool, and the "Osprey," from this port to Charleston, has called the attention of engineers particularly to the subject; and although, for three years past, boilers of this kind have been gradually coming into use, still it was not until the success of the steamers above named that entire confidence was placed in them for marine purposes. The origin of that which is called new is at all times a matter of interest, and having examined a few works on the subject, I offer some remarks, showing the progress made by the invention since 1825. On reference to *Galloway's History of the Steam Engine*, published in 1831, at page 387 we find the following:—

*Patent Steam Generating Apparatus, by Joseph Eve, of London*, 1825.

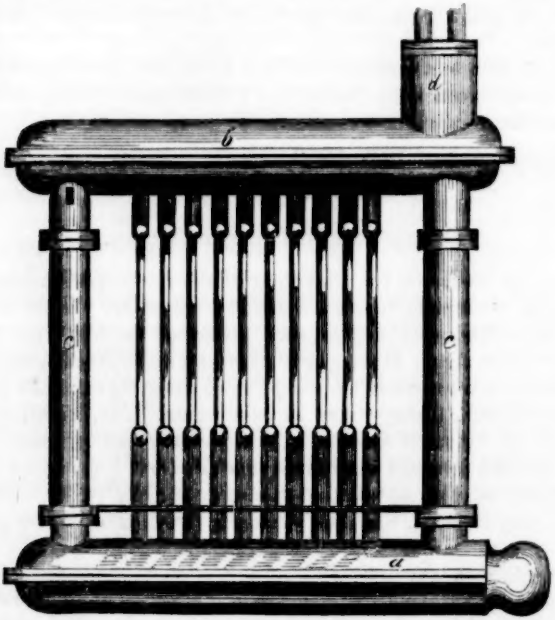


Fig. 1.

The three views here shown give a correct idea of Eve's boiler. It consisted of a top and bottom chamber, *a b*, fig. 1, the first for water, and the

latter for water and steam. These chambers were connected together at their ends by the vertical pipes *c c*, and between these were ranges of small vertical tubes, being 10 in width and depth, (100 in all;) the connexion between them is readily seen by the drawing. The small tubes were from 1 to 2 inches diameter, and were slightly bent, (figs. 2 and 3,) to prevent injury from expansion. The grate was directly below the small tubes, and the two large vertical tubes *c c*, and the horizontal chambers *a b*, are imbedded in mason-work, and the small tubes only exposed to the heat of the fire; therefore no steam will be formed in the former, (*a b c c*,) while the action of the fire will cause the steam and water to ascend rapidly through the small tubes into the steam receiver *b*, while the water therein, being heavier than the water combined with the steam in the small tubes, will descend through the pipes *c c* into the lower chamber *a*, thereby causing a continual circulation through all the tubes. The steam will, of course, accumulate at the top, and pass off through the dome *d* to the steam pipe. Such is Mr. Eve's description of his invention in 1825.

Fig. 2.

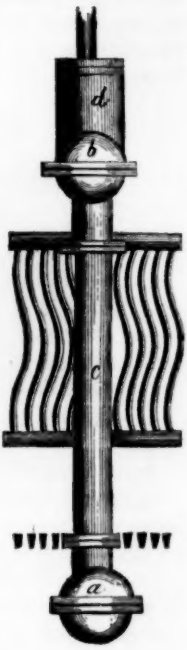


Fig. 3.

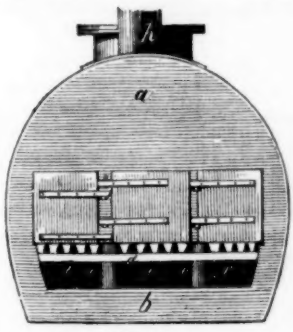


Fig. 4.

Fig. 5.

On turning to page 404 of the same work, we find the account of a patent steam boiler by Paul Steenstrup, of London, 1828, which is shown by figs. 4, 5, and 6.

Fig. 4 is an end elevation of the boiler, fig. 5 a transverse vertical section, and fig. 6 a longitudinal vertical section, the same letters of reference

designating similar parts in each. *a* is the upper division or steam chamber; *b* the lower chamber, connected with the upper by the side chambers and the vertical tubes *c c c*, as shown in the sections; *d* represents the fire bars on which the fuel is laid; *e* the bridge; *f* the ash-pit; *g* the chimney, which is likewise surrounded with water to economize the heat; *h* is the steam pipe; *k* the man-hole.

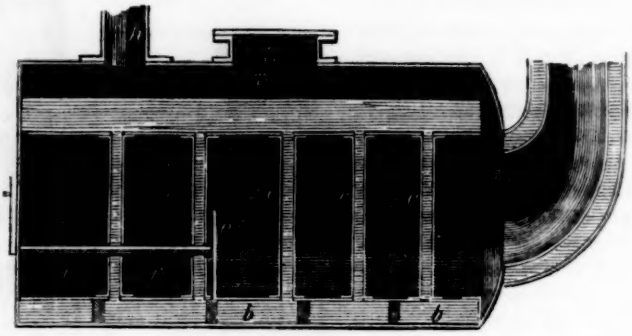


Fig. 6.

Such is the patentee's description of the parts. He then states that this boiler may be adapted to burn either coke, coal, or wood, by merely shifting the bridge back or forward; also that the tubes *c*, which pass through and between the fire bars, will acquire a higher degree of temperature than those near the chimney, and thereby cause an ascending and descending current, which is favorable to the generation of steam. Such is Steenstrup's boiler, and its approximation to some of the vertical tubular boilers of the present time will readily be seen.

The next in time is the boiler of Dr. Nott, of New York, designed by him for the steamer "Novelty," running on the Hudson river in 1830. This boiler is not as good as the two preceding, and is only introduced as belonging to this class of boilers.

Fig. 7.

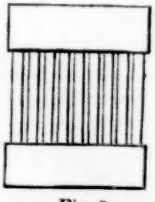

Fig. 8.

Fig. 7 is an end elevation, and fig. 8 a side elevation. The boiler consists of an upper and lower chamber, connected together by small vertical tubes; the heat passes between these tubes, and will cause the rapid generation of steam, but as there are no side *chambers*, *legs*, or *pipes*, to conduct the water down to the bottom chamber, and thus keep up the circulation, the application of intense heat to the tubes may expel the water from them. This is a very objectionable feature, and no doubt prevented their use

even on land; for boats they were peculiarly unfit from the large amount of brickwork necessary to confine the fire.

Next in order comes the boiler built about 1835, by Thos. Holloway, of Philadelphia, and at present in use on board the steamer "Camden," now towing on the Delaware. This boiler differs from those which have preceded it, in having the vertical tubes and water sides above the furnace.

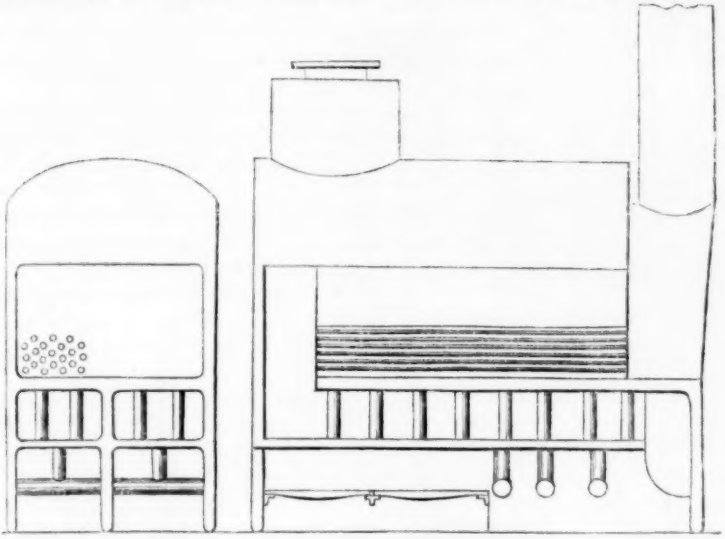

Fig. 9. Fig. 10.

Fig. 9 shows an end section, and fig. 10 a longitudinal section. The horizontal tubes, a part of which are shown above the vertical tubes in the boiler, were not originally there, but have been since added. This boiler gives great satisfaction, and has been long used. For several years after the building of this boiler no progress appears to have been made, although entire success with the boiler of Steenstrup or Holloway could easily have been obtained by increasing the number of tubes, a deficiency of fire surface being a common error of that time.

On reference to Vol. xviii., 2d series, 1842, of the *London Repertory of Patent Inventions*, at page 134 we find the specification of a patent granted to John Hall, Dec. 9th, 1841.

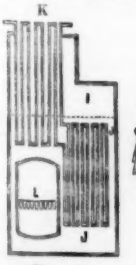


Fig. 12.

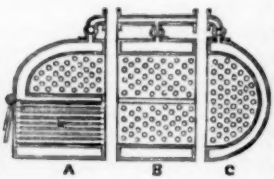


Fig. 11.

The peculiar feature of Mr. Hall's boiler is not vertical tubes and water spaces, *but the making the boiler in three parts*, so arranged that it might be easily taken apart and put together again. The two figures here shown are sufficient to give an idea of Mr. Hall's patent. Fig. 11 is a plan in section, and fig. 12 is a cross section through the furnace; the entire

heating surface beyond the furnace is composed of vertical tubes and water spaces.

Mr. Hall says the part A consists of a furnace L, chimney K, the water space J, the steam chest or space I; the parts B and C of the boiler simply consist of water spaces and tubular connexions between the upper and lower water spaces, so as to produce a circulation of the water and to offer an extended surface to be heated. On reference to fig. 11, it will be seen that Mr. Hall used a vertical diaphragm plate of brick, by which the heat was caused to pass between the tubes on one side of the boiler, and return around the diaphragm between the tubes on the opposite side.

In the use of vertical tubes and water spaces, as well as the placing of the tubes in the side flue, Mr. Hall saw nothing new in 1841, and made no claim on that account, but simply making his boiler in sections, that he might take it apart.

In the 2d Vol., 3d series, of the same work, published in 1843, at page 195 we find the following description of a boiler patented January 19th, 1843, by the Earl of Dundonald, a longitudinal section of which is here shown.

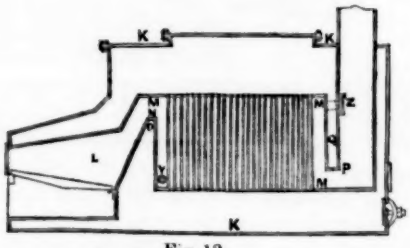


Fig. 13.

The Earl says, "This figure shows a section of apparatus for generating steam for steam engines, constructed according to this part of my invention, and the apparatus is composed partly of tubes or hollow surfaces, the interior of which are open to the water spaces of the boiler, with which the tubes are combined. Such boiler or outer vessel may be varied in shape so long as there be a chamber as hereafter described, between the furnace and fire place and the chimney. K K is a steam boiler, which may be of a square or cylindrical section, or other convenient figure; L is the fire place, M M M M is a rectangular chamber, there being a number of tubes or hollow surfaces in an upright position, through which the water flows in consequence of the water therein becoming hotter than other parts of the boiler. The heat of the fire passes into the chamber M at N, over the bridge O, at the end of the furnace or fire place; and the passage P, from the chamber M into the flue or chimney, is situated as low as possible, in order that the greater heat of the vapors may be retained in the chamber M M, for it will readily be understood that the more highly heated vapors or products of combustion will occupy the upper part of the chamber M M, and the draft into the chimney will only carry off the cooler parts of the vapors, the more highly heated being comparatively in a quiescent state, at the upper part of the chamber M; and it is the peculiar arrangement of the chamber M within a steam boiler, when containing tubes or hollow surfaces, and combined with the outlet P into the chimney, so as to leave a considerable

space above it, (for the more highly heated vapors to be retained in the chamber M,) which constitutes the peculiar character of my invention. Z is an opening into the chimney at the upper part of the chamber M M, to facilitate the getting up a draft when first lighting a fire, it being closed at all other times; Y is a steam pipe in connexion with the upper part of the boiler, having a stop cock; this pipe is drilled with many small holes in the direction towards the chimney, by which numerous jets of steam can be projected amongst the tubes, in order to sweep away the dust and ashes when required. I would remark that it is not necessary to have the tubes in an upright position."

Such is the Earl of Dundonald's account of his invention. This boiler is superior to all that have preceded it, and is *identical* with those now in use on board the steamer "Osprey," with the exception that her boilers have not the opening Z, or the steam pipe Y, both of which would be an improvement. The boilers of the "Atlantic" and "Pacific" differ from the above in having two furnaces, one above the other.

In December, 1845, James Montgomery, of Tennessee, took out a patent for a vertical tubular boiler, which is here shown.

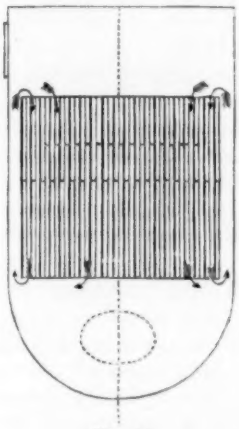

Fig. 14.

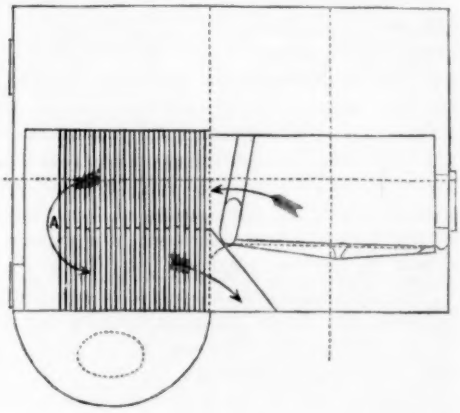


Fig. 15.

His claim is the arranging the fire chamber or furnace of a tubular boiler at the side, so that the heat shall act on the upper half of the tubes, in combination with a diaphragm, or partition, and flue, to carry off the flame, heated air, &c., to act on the lower half of the tubes after acting on the upper half as described.

He also claims the making of the bottom of the boiler of a conical or dished form, with the mud or blow-off valve in the lowest part of the concavity, in combination with the vertical tubes communicating with the bottom, in the manner herein described, to permit the deposit of the sediment, there being a water space surrounding them, (the tubes,) to induce circulation of the water up the tubes and down the surrounding space, to wash the sediment towards the mud or blow-off valve, as herein described.

From the drawing and specification the boiler will readily be understood. Its distinguishing feature is the use of the horizontal diaphragm, which,

being placed about midway in the tubes, causes the fire to act as stated. Several of these boilers have been used in steam vessels of moderate size, and for stationary engines; they have given much satisfaction, causing a considerable saving of fuel where they have been used in the place of other boilers. *Properly* constructed, this is a very good boiler, but it has no advantages over the boiler of Dundonald, and I think the diaphragm plate was introduced to correct an imaginary evil, as, in Dundonald's boiler, the lower end of the tubes can never be overheated.

Previous to this time there had existed much prejudice against tubular boilers of any kind for marine purposes, but the success attending the introduction of horizontal and vertical tubes in England, and the boiler of Montgomery in this country, called the attention of those interested in marine navigation to them; and when the steamers "Atlantic" and "Pacific" were begun under the direction of Mr. E. K. Collins, of New York, he caused a large number of experiments to be made with vertical tubular boilers for use in salt water. The performance of the steamboat "Jonas C. Heartt," with Montgomery's boiler, was carefully noted for several days, being equal in time to a trip to Europe.

It being satisfactorily ascertained that the tubes would not choke up, but, on the contrary, would keep perfectly free from scale, Mr. Collins concluded to adopt some form of vertical tubular boiler; but as the form patented by Montgomery was objectionable, from the necessity of returning the heat below the boiler, to unite all in one common chimney, thereby making a flue arrangement not at all satisfactory, he determined to test the use of vertical tubular boilers without the diaphragm plate, being, in fact, the boiler of Dundonald. After a series of experiment, proving that there was no objection, the boilers of the "Atlantic" and "Pacific" were designed by his Chief Engineer, John Faron, Jr., drawings of which are shown on the next page. (Figs. 16 and 17.)

The only difference between these boilers and those of Dundonald is in the furnaces, which are here double, one being above the other, caused by the necessity of obtaining more grate surface than could be obtained with one range of furnaces, the objection that had been urged against allowing the heat to act against the whole length of the tube having, by experiment, been found to be without cause. It is not necessary to say that these boilers, so far at least, are perfectly successful; the short passages made by these ships attest the fact. At or about the time these boilers were designed, Mr. Montgomery surrendered his patent, and obtained a re-issue, dated August 15th, 1848. He claims as follows:—

"1st, What I claim as my invention, and desire to secure by letters patent, is the employment of vertical, or nearly vertical water tubes for steam boilers or generators, that open into water chambers at top and bottom, which water chambers are connected together by a surrounding jacket or water space, made singly or in sections, to admit of the free circulation of the water, which, rising in the tubes by the effect of the heat, will descend in the surrounding jacket or external water space or spaces, and thus, by this circulation, carry off the heat from the tubes and prevent them from overheating, as described, when this is combined with the fire chamber, placed at the side of the boiler and outside of the series of tubes, substantially as described, whereby the tubes are prevented from being

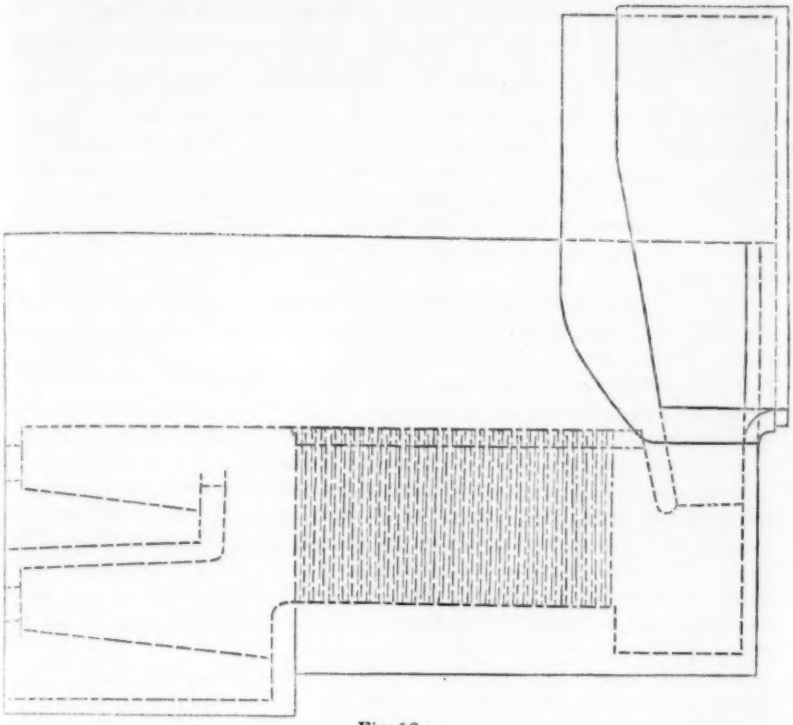

Fig. 16.

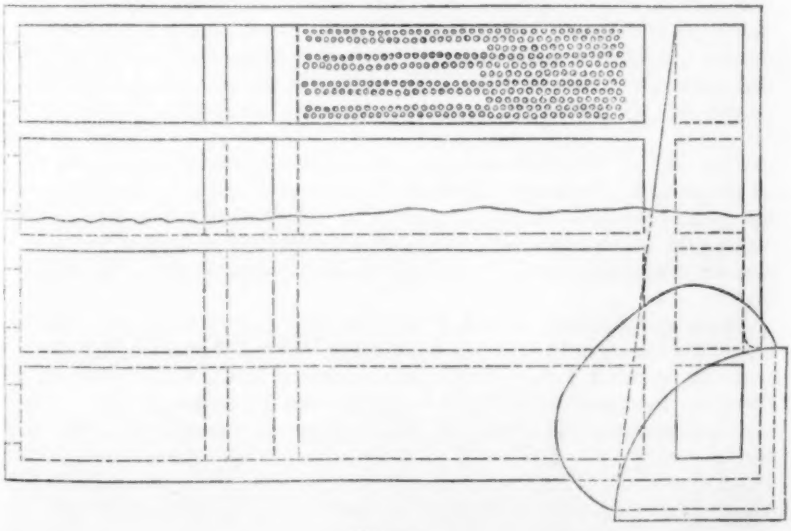

Fig. 17.

overheated and unequally expanded to an injurious extent, and the water kept cooler in the jackets than in the series of tubes, as described.

"2d, I also claim as my invention, in combination with vertical, or nearly vertical, tubes and surrounding water space or spaces, the employment of a fire chamber outside the series of tubes, and so arranged and located, substantially as described, as to apply the most intense heat at their upper ends and the reduced heat towards their lower ends, substantially as herein described, whereby a greater circulation and evaporation is obtained with a given amount of fuel than by any other plan known to me, thereby not only economizing fuel, but effectually preventing the incrustation of the tubes by the deposit of mineral and other solid matter, as described.

"3d, I also claim as my invention, the employment of a diaphragm or partition in the flue space between the series of tubes surrounded by the water space or spaces, and in combination therewith, to divide the same into two parts, that the products of combustion, after passing around the upper ends of the tubes, may pass around their lower ends, substantially as described, and thus more effectually expose the upper end of the tubes to a more intense heat than the lower, as described.

"4th, And I also claim the making of the bottom of the boiler of a conical or dished form, with a wind or blow-off valve in the lowest part of the concavity, in combination with the vertical tubes, communicating with the bottom, in the manner herein described, to permit the deposit of the sediment, there being a water space surrounding them to induce circulation of the water up the tubes toward the wind or blow-off valve, as herein described."

The claims made in this re-issue, and allowed by the examiners at the Patent Office, are in number four. The first claim is for vertical tubes, in connextion with a top and bottom chamber, and with side water spaces, made singly or in sections; this covers the boilers of Steenstrup, Hall, and Dundonald. The second claim is for so arranging the furnace outside the tubes that the greatest heat shall be applied at their upper end, and the reduced heat at their lower ends; this claim and method of arrangement appears to be the same as is minutely described by Dundonald in his patent. The third claim embodies the first part of the original patent granted to him, viz., the use of the diaphragm plate midway in the tubes, as shown in his drawing. The fourth claim is for making the bottom of the boiler conical or dished, in connexion with vertical tubes, etc.; this is also a part of Dundonald's patent, for he distinctly states that his boiler may be made cylindrical if desired, which of course gives the dished bottom.

From what has been stated, it will be seen that the vertical tubular boiler has been nearly 20 years in reaching its present position, beginning with the patent of Eve, in 1825, and ending in 1843, with that of Dundonald. I say ending *there*, for I consider that his boiler has all the elements of success. The boiler of Montgomery, as patented in 1845, although equally as effective if properly arranged, has no advantages as regards economy of fuel, and is simply a modification of the vertical tubular boilers that preceded it, although no doubt patented without the knowledge of their existence. B.

For the Journal of the Franklin Institute.

## *The Discovery of the Cause of the Felting Power.* By P. A. Browne, LL. D.

"Nulli negabimus, nulli differemus Justitiam."—Magna Charta.

In the 6th Vol. of the *Ann. de Chem., p.* 300, published in Paris in 1790, is an article from the pen of M. Monge, entitled "Observations sur la mechanisme du feûtrage," in which he explains the operation of felting and the effect of fulling, by *the external conformation of the wool and hair of animals.* The following are the chief points of his observations:—

1st, Nothing, he says, can be discovered by means of the microscope, in the filaments of wool or hair, yet the surfaces are not smooth; they must be formed either of small laminæ slanting towards the point, like the scales of a fish, or more probably of zones placed one upon the other, as in horns, &c.

2d, He notices the different *feelings* experienced when a hair is drawn through the fingers in different directions. And he concludes that, as a hair meets with more resistance when sliding from its point to its root than in the opposite direction, that these scales or zones are the cause.

The author of the essay then remarks that this structure is the principal cause of the felting process. "The pressure (he says) brings the filaments of the wool nearer to each other, and multiplies the points of contact; the agitation gives each fibre a progressive motion in the direction of its root, by means of which they entangle, the laminæ of each filament taking hold of those of the opposite ones, and the whole is retained in close contexture," &c. He adds that "it is necessary that the filaments should not be straight, like needles, for that would induce them to continue the motion without change of direction." This he gives as the reason why the fur of beavers, hares, and rabbits cannot be felted, without rubbing them with a liquid, which, acting on one side of the hairs, changes their directions, &c.

This is probably the first enunciation, in clear and decided terms, of the existence of the *scales* upon pile, and their connexion with the processes of *felting* and *fulling;* but it must be acknowledged that one of the facts upon which the theory was founded had been previously noticed by Fourcroy.

In *Nicholson's Dictionary of Chemistry*, (the 4to edition, published in 1795,) Vol. II, p. 1061, this article of M. Monge is noticed, and its claims to originality are unimpeached. In truth, no one felt disposed to dispute it, for no one seemed to consider it worthy of confidence. Dr. Young (in his *Natural Philosophy*, Vol. I, p. 186) had attributed felting to *the attraction of cohesion*, and Mr. Luccock had endorsed this opinion. "Mr. Monge (says the Doctor) thinks that the hairs are united by projecting serrations or filaments; but this supposition is not necessary in explaining the *adhesion* of felts, which may be deduced from the *force of friction alone.*" "The particles of thread (says Luccock) are brought in contact, and cohere exactly upon the principle of the leaden balls exhibited to illustrate the attractive power of bodies." Mr. Livingston, (whose book was published in 1799, under the authority of the Senate of New York,) was a gentlemen not only of considerable experience in the growing and manufacture of wool, but he had, during his foreign mission, collected

much valuable information upon those subjects; yet he appears to be entirely unconscious of this cause of the felting and fulling property. In page 155 he says, "common wool can hardly be too much carded, merino may; the first gains by being broke [broken] to a certain degree, the last is injured. The object of fulling (he adds) *is to unite the* ENDS *of the wool so as to raise the nap*, &c."

We are therefore justified in the inference, that this theory of Mr. Monge had, at that period, (1799,) taken as little hold of the public mind in Europe, as it had in this country; the seed had been dropped, but it lay dormant.

The celebrated anatomist and physiologist, Bichat, composed his *Anatomie General*, &c., probably about the year 1800, for he died in 1802, and it was not published until about 1804 or 5. In *it* we find this passage:

"Several modern authors say that there may be detached from the exterior envelope of hair a species of scales, which are formed like little branches. You do not perceive their prolongations, nevertheless experience teaches, (as Fourcroy has observed,) that in rubbing a hair between the fingers it moves always like a beard of grain-head, in the direction from base to point, which appears to prove the existence of these *insensible* prolongations, which play an essential part in the adherence of hairs to one another, an adherence from which, when they remain long entangled, as in protracted diseases, they cannot be separated but with great difficulty."—*Bichat's Anat. Gen., Vol.* II, *p.* 787, *of the new ed. of* 1818.

The first merino sheep brought to this country was in 1801, and the gentleman who caused him to be brought was Mr. Delessert, of Paris. In 1809, Mr. Livingston wrote his essay on sheep, before alluded to, which was published by the Legislature of his State. This work attracted much attention, and merino sheep were soon imported, and breeds of our own improved to a very considerable degree.

During the war of 1812,* many patriotic and scientific American gentlemen engaged in the manufacture of woolen goods, and among the rest Mr. Thomas Gilpin, then of Brandywine, Delaware, now of this city; and he assures us that it was often the topic of conversation among these manufacturers, that wool depended for its felting and fulling power upon *certain rugosities of the fibres*, (cortex,) which they called the "*beard*."

The French society for encouragement of national industry having offered a premium of 600 francs for the best essay upon felting wool for hats, on the 8th December, 1828, the committee reported upon one of a Mr. Felissent, in which it was stated that the fibres of the wool of Denmark, from their roots to within one-third of their length, are covered with *scales*, &c.; that those of the lambs of Sologne extend the whole length; and that it is by the root that wool works (chemine) in the operation of felting, so that the felt ought to be more compact, as the scales, *which hinder the retrograde movement*, occupy the greater space upon the fibres.

The committee, in awarding a gold medal, remark that "the essayist has adopted the ingenious explanation of Mr. Monge of the mechanism of felting."

* "The American war (says Dr. Ure) gave a disastrous interruption to our old staple manufactures, and caused the price of wool to fall, towards its close, lower than ever it had been when money was more valuable.

Several inferences may be drawn from the above paper, as, 1st, That the existence of the *scales* upon the fibres of hair and wool still depended upon proofs founded upon the sense of *touch*,—no one had yet *seen* them. 2d, That Mr. Felissent was indebted to Mr. Monge for the chief information for which he received the gold medal. And 3d, That, relying upon the theory of Mr. Monge in regard to the felting fibres working their way into the mass *root foremost*, he had erroneously supposed that the only use of the scales was to prevent their retrograde movement.

After this, the whole subject seems to have slumbered again for nearly seven years. At length, viz., in 1835, Mr. Youatt submitted the fibres of merino wool to the microscope, and *saw the scales*.

Dr. Ure, in his *Dictionary of the Arts*, under title Felting, says "the different fibres get interlaced by their ends pursuing ever tortuous paths, their vernicular* motion being always, however, root foremost.

This work, it is true, was published in 1839, but as it is a volume of 1334 pages, and its compilation evinces great labor, it was probably commenced *before* 1835. We think that if its learned author had been acquainted with the real cause of the felting property, or even had known of Mr. Youatt's discovery, he never would have given his readers the above description of the art. Under the title Wool, which is, of course, near the end of the same book, and was probably composed in 1838, the Doctor says, "Two years ago I made a series of observations on wool, &c.; their structure under the microscope shews, at intervals of $\frac{1}{300}$ of an inch, a series of serrated rings, imbricated towards each other, like the joints of an equisetum, or rather like the scaly zones of a serpent's skin; (see *Philos. of Manuf., p.* 91, *fig.* 11 *and* 12.")

Upon turning to the book and page referred to by him, we find drawings and descriptions of the scales, shewing that they had been *seen*, but were still imperfectly understood. In regard to the felting process, the Doctor's opinion was changed, for he says, "the felting property depends upon the *serrated mechanism*, but it is not proportional to its development; the imbrications of the fibres lay hold of each other as clicks do to ratchet teeth, so that when the wool is alternately compressed and relaxed, in mass, they cause an intricate loco-motive among the filaments, urging them onward, until they become compacted into a solid tissue called felt." And, in a subsequent page of the same work, this learned lexicographer remarks that "the felting property of wool is in some measure proportional to its softness, and depends conjointly on the annular and other rugosities (the scales) of the filaments, and on their elasticity. In consequence of this structure, when they are pressed and rolled together they become convoluted and entangled by mutual friction. Heat and moisture favor the flexure and curling of the wool, which are essential to the matted texture. For this purpose only the *curling fibres* are fitted, which continually change their direction in the fulling movements, and thereby *interlace themselves round other fibres*."

We think that it will be apparent to the reader that, although the knowledge of the Doctor, in regard to the cause of felting, was considerably improved since he wrote the first article, yet that it had not attained that perfection in the theory of this art of which his vigorous mind was capable.

* Qu. Vernacular, from Vernaculus?

Hitherto the ocular demonstration of the scales had been confined to the coats of the animals inferior to man, but it was soon to be extended to the hair of man.

In the 10th Vol. of the *Edinburgh Journal of Science, p.* 327, published in 1839, it was announced that Dr. Goring and Mr. Andrews Prichard had made improvements in the microscope, and the first number of their valuable work on that instrument is noticed; and in subsequent essays of this gentleman these discoveries are detailed.* (See also *Gill's Technological Repository, Vol.* IV, *p.* 130.)

In Bostock's *System of Physiology*, (the 4th edition, published in London in 1844,) the author informs us that a hair consists essentially of an external tube and an internal pulp, the tube being delicate and entirely filled with pulp. Although the hair seems to be smooth to the touch, we are informed by Bichat that it actually posseses an imbricated or bristled texture, the processes all pointing in one direction from the root to the tip, analogous to the feather part of a quill; and that it is upon this structure that the operation of felting depends, in which the hairs are mechanically entangled together, and retained in that state by the inequality of their surface.

In a note, this author announces that this peculiarity of structure has lately been confirmed by Dr. Goring; and then, after noticing that the scales were not remarked by Lewwenhook,† nor Fontana, nor Hooke, nor Young, Mr. Bostocks sums up in this remarkable manner: "*I may further remark that I had an opportunity of viewing the hair of various kinds of animals in (under) the microscope of Mr. Bauer, but was unable to detect these appearances.*"

In the 2d Vol. of Gibbs' *Technical Repository, p.* 41, the editor says: "We have no knowledge of the kind of microscope employed by Mr. Bauer, but believe that his admirable delineations owe the principal part of their merit entirely to his great skill as a miniature painter." And Dr. Ure (in *Philos. of Manuf., p.* 90) says that "he entertains no doubt of the general skill of Mr. Bauer, but he conceives that the nature of the *medium* in which his objects were placed for inspection has affected their forms very considerably, by refracting or diffracting the light by which they were viewed."

What a lesson is afforded by a perusal of the last few pages, and in what a clear light do they place the obligations which the mass of mankind are under to those few philosophers who devote their whole time and attention to objects of deep thought. Here was a question, "*upon what property or quality in fur and wool depends the simple yet important operations of felting and fulling?*" More than a quarter of a century ago, a gifted French gentleman, probably instigated by an apparently insignificant remark of one of his countrymen, that "a hair rolled between the fingers always progressed from root to point," suggested that the operations of felting and fulling depended upon the structure of the fibres. Let any one read the observations of Mr. Monge, and reflect upon what slender proof he based

* "A hair, (says this gentleman,) viewed upon a dark ground, is seen to be indented with teeth, somewhat resembling those of a coarse rasp, but extremely irregular and rugged. These incline all in one direction, like those of a common file," &c.

† Lewwenhook wrote in 1677, and both he and Hooke used very imperfect microscopes

his theory, compared with the strong reasoning upon which he supported it, and he must come to the conclusion that much credit is due to him.

Five years were allowed to pass before these observations of Mr. Monge attracted notice, and then they were published in a chemical dictionary *without comment*, and were denounced by Dr. Young and Mr. Luccock. Nearly fifteen more years rolled away, and yet so little was thought of this important suggestion, that Mr. Livingston, in his laudable pursuit after everything that could enlighten his countrymen upon his return from Europe, never stumbled upon them.

Bichat, whose young and active mind nothing escaped, gave this cause of felting a few passing remarks in his great work on general anatomy, and all was silent again for another series of years, until Mr. Felissent, allured by the golden prize offered by the French Society of National Industry, appropriated the discovery of Mr. Monge to himself, and bore off the palm!

Up to this time, and for seven more years, no one had *ocular demonstration* of the *scales*, when Mr. Youatt submitted the fibres of the merino sheep to that potent instrument of investigation, "without the aid of which (says Mandel) no one can speak of an object without experiencing a just timidity." With this tardy discovery one might reasonably have expected that the human mind, at least of the man of science, would have been satisfied; yet, strange to tell, an eminent physiologist, in 1844, throws a doubt over the whole subject again, corroborated as it is by the testimony of Dr. Goring, because *he* was unable to detect these appendages *through an imperfect medium, and with little or no experience with the microscope.* We sincerely hope that we have been able, by this brief review, to rescue the names and do credit to the memories of MONGE, BICHET, and YOUATT.

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For the Journal of the Franklin Institute.

## *Iron and Wood Paddles for Marine Steamers.*

From an experiment recently made in New York, to test the comparative strength of iron and wood as a material for the paddles of marine steamers, it was found, on subjecting a wooden paddle of 3 inches thick, and an iron one of $\frac{9}{16}$, to the same pressure, the deflexion of the latter was 1 inch to $\frac{3}{16}$ inch in the former. B.

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## *Report upon the Telegraphic Apparatus of* M. SIEMENS, *of Berlin, presented to the Academy of Sciences, Paris.**

The telegraph presented by M. Siemens to the Academy is of the kind known as alphabetic telegraphs. Telegraphs of this nature have hitherto been constructed and worked upon the following principle:—The two stations (Paris and Berlin for example) between which communications are required to be made, are united by two insulated wires, which are either stretched across posts, set up at about 50 yards apart, or enclosed in a durable non-conducting material and buried in the ground. If a battery be established at Berlin, having its positive pole in communication with one

* From the London Journal of Arts, Sciences, and Manufactures, Vol. xxxvi., 1850.

of these wires, and its negative pole with the other, this is not sufficient to establish a current: for the circuit will be broken at Paris,—the ends of the two wires not being in communication. But if the circuit be closed at Paris, by joining the two wires, or uniting them by any conducting material, the current will be immediately established, and the electric fluid will circulate permanently throughout the wires, as well as through the apparatus by which they are united. In this arrangement, it is stated, in common parlance, that the fluid travels from Berlin to Paris by the wire which communicates with the positive pole of the battery, and returns from Paris to Berlin by the wire which communicates with its negative pole. Care must, however, be taken not to construe literally the received expressions which denote coming, returning, and circulating; for by them it is not meant that the electric fluid really circulates, or that it undergoes a movement of transmission analogous to that of a liquid flowing through a tube, or of gas passing from a gasometer to the burner,—they only mean, that the effect of the electric fluid is felt at the different points of the circuit. When, for instance, sound strikes an echo and rebounds to its starting point, it may be said that it has a backward and forward or a circulating movement; and yet we are well aware that, in reality, the air does not travel from the point where it is disturbed to the surface forming the echo, and thence back to the starting point,—for, instead of traveling, the air merely vibrates, and these vibrations are successively transmitted from one to another with a certain speed; it is, therefore, the action and reaction of the primary impulse which is transmitted, and not the fluid itself; or, in general, the medium which receives the impulse: this must be understood, when speaking of the transmission of the electricity, in the same manner as when speaking of the transmission of sound or of light. The electric current circulates, therefore, from Berlin to Paris, and from Paris to Berlin, on the condition, 1st, that the battery furnishes electricity; 2dly, that the wires are properly insulated; 3dly, that the circuit is complete at all points along the line of communication. If the wires should happen to communicate electrically with each other,—if, for instance, they are united by a fine wire, or by a stream of water, or by damp, or by any other conducting arc, this conducting arc instantly becomes the seat of a derived current, which weakens, in a certain degree, the remaining portion of the circuit.

Theory allows the intensity of a current to be calculated throughout the various portions of its circuit, thus ramified in the most complicated manner, provided all the elements of these ramifications can be arrived at.

Theory has also pointed out a doubly-economical method of establishing a circuit between two distant points, such as Berlin and Paris;—this method consists in dispensing with one of the wires, and using the earth itself as a medium of communication. Let us suppose, for instance, that there is only one wire stretched between these two points, and that at Paris its extremity communicates with the earth by means of a large plate of metal, immersed in the Seine, or even in a well,—and that the negative pole of the battery communicates also with the water of a well, and, consequently, with the waters of the Spree: it will be understood that, immediately the positive pole touches the extremity of the wire, the current will, as above stated, come from Berlin to Paris by the wire; but, instead of returning to Berlin from Paris by another wire, it will return through the waters of the

Seine, the North Sea, the Elbe, and the Spree, and also through such portions of the earth as possess sufficient conductibility to allow of its passage. It is then said that the earth forms a portion of the circuit; and thus a double economy is effected,—first, by avoiding the expense of a second wire; and secondly, inasmuch as the earth, from the great space which it offers to the current, opposes to its progress much less resistance than a second wire.

We will add a few words respecting telegraphic signals:—As the current which passes continuously through a circuit (formed by two wires, or by one wire and the earth) only produces a constant and uniform effect, it is not well adapted for producing the necessarily varied signals which are required for the expression of various ideas. It is therefore requisite to obtain from the current different effects, and to combine them, until a number of signals are obtained, sufficient to reproduce all that is required to be expressed. This is effected in a very simple manner, by interrupting the current and again re-establishing it, and so arranging the apparatus as to cause this alternating action to give rise to a backward and forward movement of greater or less rapidity. For this purpose an electro-magnet is introduced into the circuit, which becomes a magnet during the passage of the current, and loses that property immediately the current is interrupted. So long as it is magnetic it attracts its armature, which is drawn back by a spring when its attractive power ceases;—thus the armature is caused to oscillate or vibrate between the magnet and the spring. These vibrations may be caused to take place with almost inconceivable rapidity, as it is very easy to construct an apparatus capable of producing several hundred in a second; and there seems no reason to doubt that this number might be increased tenfold. It will be seen, however, that there is one condition absolutely necessary for this purpose, viz., a due proportion between the power of the spring and that of the electro-magnet: the power of the latter depends upon various conditions, but more especially upon the intensity of the current.

An alternating motion being obtained, of the required speed and regularity, it is easily converted into rotary motion, whereby a needle may be made to travel round a dial upon which the letters of the alphabet or other conventional signs are marked. To enable the letters to be read, it is sufficient to cause the needle to stop for a very short time (a quarter of a second for instance) opposite any particular letter;—words are thus formed, and have merely to be taken down as fast as the telegraph acts. In this way each single oscillation might be made to correspond to a letter on the dial; it is, however, generally thought more advisable to arrange the apparatus so that one letter should be passed at every double oscillation only: thus, supposing there are thirty signs upon the dial, thirty double oscillations of the armature will be requisite to enable the needle to travel right round the dial. By this means the needle is only stopped for an instant at the end of the double oscillation: that is to say, whilst the armature is under the action of the spring, and not attracted by the magnet.

It now remains to explain the manner in which the operator at Berlin, on transmitting his message, interrupts the current with the required speed and regularity; and how he is enabled, with certainty, to stop the needle at the other station, viz., at Paris, exactly at the required letter. For this

purpose he has an *interrupter*, viz., a wheel of, say, 60 centimetres in circumference, and divided into 60 equal parts: these divisions, forming a cylindrical surface on the periphery of the wheel, are alternately of metal and ivory, *i. e.* conductors and non-conductors; and, opposite these non-conductors (thirty in number), thirty signs, employed in the telegraph, are arranged in the same order as on the dial at Paris. The two ends of wire, which are to come in contact to complete the circuit, are made to bear against the periphery of the interrupter,—both ends being upon one of the divisions of the wheel: when they come opposite a metal division, the circuit is complete, and, consequently, the current is in action; but when an ivory division comes under the wires the circuit will be broken, and, consequently, the current will be interrupted. Thus, if the operator turns the wheel by hand one entire revolution, (commencing with an ivory division,) it is certain that the circuit will have been thirty times broken and completed, and that the electro-magnet will have been thirty times converted into an electro-magnet, and thirty times deprived of its power; the armature will have made thirty double oscillations, and the needle will have made an entire revolution round the dial, in the same manner as the interrupter at Berlin. If the two accorded, *i. e.* if they corresponded with the same sign or letter on commencing, they would agree at the conclusion; and nothing can be easier than to cause them to correspond. Each station must be furnished with the two kinds of apparatus above described, viz., the interrupter for transmitting the message, and the dial for receiving it; there is also a third apparatus, called the alarm bell, which is only introduced into the circuit when the correspondence is stopped, but which enables the party desirous of sending a message to signal the party at the other station.

All alphabetical telegraphs constructed previously to M. Siemens' are upon the above principle; and they may be characterized generally, by stating that they are provided with an interrupter worked by hand by the party sending the message, and that, consequently, the party receiving it is obliged to remain passive until his correspondent allows him to speak; and that, although various kinds of apparatus have been employed, the only variations have been in the methods of converting the reciprocating into rotary motion; or in the arrangement of the dial, or the form of the interrupter, or the number of its divisions.

To be Continued.

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## *On the Properties of the Diamond for Cutting Glass, with descriptions of machines invented by the author, in which the Diamond is made to perform perfectly what by manual labor had before been very imperfectly done.* *By* Mr. Antoine Claudet.*

The author commenced his paper by a very interesting description of the nature of the diamond, of the form of its natural crystal, and of the mode in which it cuts glass,—quoting a paper on the subject by the late Dr. Wollaston, in the *Philosophical Transactions* for 1816, as well as by a

* From the London Civil Engineer and Architect's Journal, for June, 1850.

history of the use of glass in windows from the earliest times, when it was used only in ecclesiastical buildings of great splendor, down to its present universal application. He has also, in order the more thoroughly to make apparent the advantage of the use of the diamond, described minutely the very tedious and imperfect methods by which, before its introduction, glass was cut and shaped. The property in question was first found out about the time of Francis I. of France, the well-known anecdote of whom is quoted; and the different tools used from that time to the present for its manual application are detailed and commented on, many of them being exhibited by the author. The first of these was a mere handle, having the diamond firmly inserted into the lower end. But the handle being round, and the diamond, from the form of its crystal, requiring one unvarying direction to be preserved in order to produce a cut, this was found so imperfect that a step was taken by making the end of the handle flat, to preserve the parallelism against the rule. This, from the shape of the bottom in which the stone was set, was called the "plough diamond." In 1814, Shaw, of London, made a great improvement, and brought the instrument to the shape in which it is still used, by making the metallic setting of the diamond movable on a ferrule at the bottom of the handle, thus putting it out of the power of any deviation of the hand from the proper position to affect the direction of the stone. This, perfect as it may seem, is still difficult to use, and requires long practice for expert performance. The two tests by which the workman knows when his tool is "making a cut" are the sound and the feel. A modification of the last-named tool, by the brother of its inventor, was formerly used for those who have but little practice; but it was very little used, and the one shown to the meeting by Mr. Claudet was curious, from being, perhaps, the only one now in existence. A contrivance for cutting circular plates was shown in action.

The cause of the invention of the machines, the description of which was the principal object of the paper, was the increased use of glass shades for covering ornaments, the cutting of which, so that they should stand perfectly firm and with an even base, was a most tedious and imperfect operation when done by hand. The manufacture of these shades, which, under the name of "cylinders de verre," had long been carried on in France, was first undertaken in England, at the instance of Mr. Claudet, by Mr. Lucas Chance of Birmingham, who, in the true spirit of enlightened enterprise, notwithstanding the vexatious pressure of the excise laws, now repealed, embarked largely in the manufacture, getting workmen from France, for making both shades and the sheet glass, which had there been for some time made from cylinders. It was now, however, found that some method of cutting the bottom of the shades and cylinders must be adopted surer and less expensive than the manual method, and Mr. Claudet was driven by this necessity to invent his machine.

The principle of the machine, expressed in the fewest words, is this: The shade is firmly fixed between an internal support and a transverse bar above it, in a perfectly upright position, above a horizontal, level, and smooth table, its bottom being a few inches above the table. Upon the table travels a small but heavily-weighted base, moving on castors, having springing from it two upright pillars, one holding the diamond, and the

other forming a support opposite to it. The pillar holding the diamond is fixed, but the other is movable, being by a spring kept close to it. The height of the whole is such that, when on the table, the diamond is about an inch above the bottom of the shade. The diamond being introduced inside the shade as it hangs suspended, the pressure of the spring is sufficient to cause it to cut, and it has only to be moved round the shade, the horizontality of the table causing the cut to be perfectly level. This machine was exhibited, and the bottoms of shades cut by it, before the meeting. The shape of the shade, whether oval, round, or square, is unimportant in the use of this machine, but Mr. Claudet has contrived another for the cutting of round shades only, in which the shade is laid horizontally,—an elegant system of adjustments being provided, by which shades of any diameter can be cut by the workman with little risk of error. This machine was also shown in action.—*Proc. Soc. Arts, Lond.*

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*Exhibition of the Massachusetts Charitable Mechanics' Association.*

This Association propose to hold this year their Sixth Exhibition of American Manufactures. It will be held in Boston, and will be opened for visiters on Wednesday, 11th September, but no goods can be entered to compete for a premium, or can be inserted in the catalogue, after Saturday, 7th September.

The high order of excellence which has hitherto marked the exhibitions held under the auspices of this Association, and the good taste and efficiency which has characterized their arrangements, will ensure for them an interesting collection of goods, and we especially invite the attention of our subscribers to their circular. The question of the utility of such exhibitions, both to the manufacturers themselves and to the country at large, may now be considered as entirely settled, and their rapid spread throughout our whole land shews that they are appreciated by those whose interests are concerned in them.

Notwithstanding the temptations held out by the great world competition to be held in London during next year, we hope all our mechanics and producers will recollect that their true interest is best subserved by the maintenance of such institutions at home, and that this country is and must be the principal consumer of its own goods. A comparison of our powers of production with those of European countries, if a fair opportunity for it be granted, must be advantageous to us in many ways,—in none more than in pointing out to us our deficiencies; but the constant exhibition of the products of our own industry to our own people is almost essential to the maintenance of our manufactures, and, by means of them, of our true national independence.

There will be four such exhibitions held during the ensuing fall, in the following order:—

At Boston, commencing on Wednesday, 11th September.
At New York, commencing on Tuesday, 1st October.
At Baltimore, commencing on Monday, 14th October.
At Philadelphia, commencing on Tuesday, 15th October.

We hope that they will all prove successful. Ed.

## FRANKLIN INSTITUTE.

*Proceedings of the Stated Monthly Meeting, August 15th, 1850.*

Thomas Fletcher, Vice President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Letters were read from The Royal Geographical Society of London, and from The Massachusetts Charitable Mechanic's Society, Boston, Mass.

Donations were received from The Chemical Society, The Royal Astronomical Society, and The Royal Geographical Society, London; The Royal Irish Academy, Dublin; Hon. A. C. Green and Hon. Joseph R. Chandler, U. S. Congress; Messrs. Little & Brown, Boston, and John C. Trautwine, Esq., Philadelphia.

The periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of receipts and payments for the month of July.

The Board of Managers and the Standing Committees reported their minutes.

The Chairman of the Committee on Exhibitions reported a resolution passed by the Committee, amending the regulations for the government of the Committee, which they asked to be adopted by the Institute, and that authority be given to the Committee to carry the same into effect.

New candidates for membership in the Institute (5) were proposed, and those proposed at the last meeting (2) were elected members of the Institute.

On motion, the resolution proposed by the Committee on Exhibitions was laid on the table for the present.

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## BIBLIOGRAPHICAL NOTICE.

*A Treatise on Plane and Spherical Trigonometry. By* Wm. Chauvenet, A. M., *Professor of Mathematics in the United States Naval Academy. Philadelphia,* 1850.

This work is an important addition to our mathematical literature, being the most complete treatise on trigonometry extant in the English language. While it contains everything useful to the mathematician and astronomer, the more elementary portions of the work are easily distinguished by the larger type in which they are printed, and form of themselves a connected treatise adapted to the wants of the young student. Those who wish to pursue the subject to its higher developments cannot fail to appreciate the advantage of having them treated of in connexion with the more fundamental considerations to which they are related.